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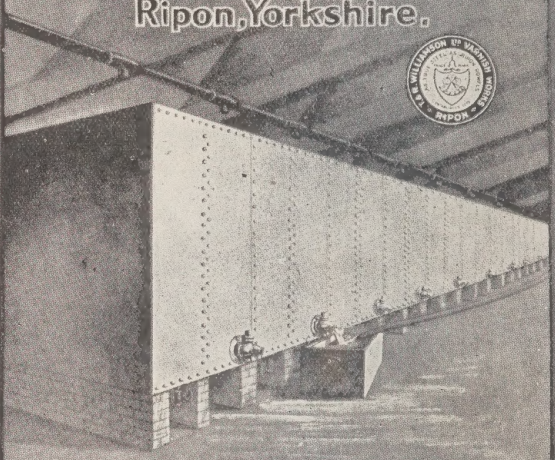

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ARTHUR SEYMOUR JENNINGS,

Past President of the Institute of British Decorators, Editor of "The Decorator" and the "Decorator Series of Practical Handbooks," Author of "Decoration and Renovation of the Home," "Painters' Pocket Book," "Wall Paper Decoration," "Commercial Paints and Painting," "House Painting and Decoration," "Painting by Immersion and by Compressed Air," etc., Consulting Examiner to the City and Guilds of London Institute in Painters' and Decorators' Work," Hon. Member of the National Federation of Master House Painters and Decorators of England and Wales Incorporated, Honorary Member of the International Association of Master House Painters and Decorators of the U.S.A. and Canada.

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PREFACE TO THE SEVENTH EDITION.

In preparing a new Edition of this book, many important additions have been made, including a chapter on the "Proportions of Pigments and Thinners in Paints"—a subject of great interest both to the painter and paint manufacturer. There are also new chapters, "Hints on Choosing Colour Harmonies," "An Exhaustive List of White, Black and Coloured Pigments with Their Properties, Principal Uses and Alternative Names," and "Colour Glazing."

The book has been carefully revised throughout and the text has been brought up-to-date by the inclusion of pigments, colours and methods not well known when the earlier editions were published.

There are also included descriptions and illustrations of most of the latest types of machines used in paint grinding and paint mixing.

The plates are all new and two of them, Plates XIV and XV, are of special interest. They give a selection of the colours for ready-mixed paints selected by a special panel appointed by the British Engineering Standards Association to name this class of colours. The author is a member of the panel and acknowledges with many thanks the courtesy of his colleagues and also the Association in permitting him to publish this selection of colours in advance of the complete list which will shortly be published.

The present edition of this book brings the total number issued since 1902 up to the very satisfactory total of 17,000 copies.

ARTHUR SEYMOUR JENNINGS.

4, Brunswick Square,
Hove, Brighton,
September, 1926.

PREFACE TO THE SIXTH EDITION.

WITH the present edition, this book reaches a total issue of 15,000 copies—an unusually large number for a technical work.

Originally the book was intended merely as a guide to painters who were more or less deficient in the knowledge of the art of paint mixing and colour mixing From this point of view it was a great success, and as subsequent editions were produced, a great many new colour names and specimens were added. The instructions for mixing different colours will, it is hoped, be found to be clear and exhaustive.

Experience proved that the book appealed very strongly to master painters, who found it most useful to show to their customers, in order to ascertain their tastes in the colours which they wished used in the decoration of their houses. Having been instructed to use any particular colour given in the book, it was a simple matter to order it from a paint manufacturer, who would probably have a copy of the work on hand, so that, by quoting the number of the plate and specimen, the exact colour required would be known.

A further use of the book to paint manufacturers has been found as a guide in mixing and naming new tints and shades.

The author hopes, therefore, that this edition will be even more successful than those previously issued. All the plates are quite new, and some of the text has been enlarged and re-written.

ARTHUR SEYMOUR JENNINGS.

Office of "THE DECORATOR,"
326, Bank Chambers,
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January, 1921.

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CHAPTER I.

Paint and Colour Mixing: Introduction.

The Composition of a Paint.—Clearly the first thing to be done before studying the subject of paint and colour mixing is to define "paint" and "colour." Without attempting to give a hard and fast definition, it may be said that a paint consists of any pigment, or pigments, such as white lead, tinctured or used plain, mixed with linseed oil, and thinned by means of turpentine to render it in such a condition that it may be readily applied to the surface of wood, iron and other work by means of a brush. Paint serves the purpose, first of preserving the material to which it is applied, and sometimes, but not always, a second purpose, namely, that of decoration or adding to the beauty of the object to which it is applied.

The principal pigment used in paint mixing is white lead, but there are many others that are also employed. Many painters look upon paint as necessarily consisting of white lead, to which has been added sufficient colouring matter to give the desired tint. As a matter of fact, white lead may be wholly absent from a paint. For example, yellow ochre or leadless green may each be used by itself. Iron oxide in the shape of Indian red, purple brown, or Venetian red, form in themselves good paints if the colour is not objectionable. Red lead used by itself is a useful paint. Again, in the white and lighter paints, we sometimes have white lead replaced by zinc oxide, lithopone, Charlton white, Orr's white, and other white pigments, which may be used alone or be mixed with a small proportion of barytes, asbestine and other materials.

The oil used in mixing paint is principally used

to combine or unite together the particles of which the pigment is composed. It is also employed to give a glossy surface and to bring the material to a proper consistency. Turpentine could be used for the latter purpose by itself, but the result would be what is termed a "flat" surface, or an absence of gloss. The turpentine, too, evaporates almost wholly. It is generally conceded, among those who have given close attention to the subject, that the durability of a paint depends largely upon the oil used; indeed, it has been likened to the life blood of the paint. Recent investigation has shown that it depends also and to a very great extent upon the fineness of the particles. A perfectly pure, but coarsely ground pigment, when made into paint, will not last nearly so long as one which is finely ground.

There is not much doubt that the best pigments may be replaced with others somewhat inferior without so much detriment to the quality of the paint as if linseed oil is replaced by some other oil. It is quite necessary that pure linseed oil be used in the manufacture of all paints, and although there are one or two substitutes on the market which may be employed in very cheap work, no attempt should be made to execute a really good job unless pure linseed oil is used. The purpose of the oil in giving a gloss is sometimes assisted by the addition of a small quantity of oak varnish. This is a growing custom among painters, as the gloss produced is decidedly improved by the addition of the varnish, and the work shows up well, while the varnish does not in any way detract from the durability of the paint, but rather adds to it. This practice is employed more on outside than inside work, where the execution of the painting requires more care than it does inside, owing to the severe atmospheric conditions, which cause any paint work not properly prepared to soon decay.

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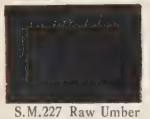
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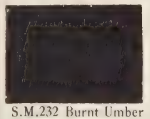
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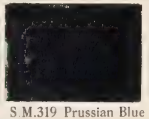
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For our present purpose "colour" may be defined as a pigment possessing a hue or colour in itself which it imparts to the white lead or other white pigment with which it is mixed, thus producing a series of "tints" according to the proportions employed. It is for this reason that colours in painter's parlance are frequently called "stainers," although the word is not quite correct, as it implies an effect similar to that which would be produced by the use of a stain or dye. As a matter of fact coloured pigments, when mixed with white ones, do not actually stain, but the particles lie side by side and become merged into each other when viewed at a little distance.

In mixing a paint the base, such as white lead, having been selected, a colour is mixed with it in order to produce the desired hue or tint. Frequently, however, a colour is made by the mixture of several colours, which are added to the base, or sometimes a single colour may be used by itself, or several colours without white at all may be employed.

The colour having been determined, oil, turpentine, and driers are then added. The object of the driers is that of causing the paint material to dry quickly. There are several kinds of driers on the market, but the two best known are termed "patent driers," which is sold in solid form, and the "liquid driers" or "japanners." Whichever is used, the actual quantity employed will depend very largely upon the pigment. Some pigments, such, for instance, as red lead, may be considered in themselves driers, and the addition of any other is unnecessary. Others, like Vandyke brown, dry slowly, and much more driers will be necessary than is the case with white lead. Further on we give some idea of the proportions of materials to be used, but it will be understood that no exact information on the subject will be possible, for reasons that will be explained. It is of the utmost importance to remember that an excess of driers is most objection

able. It often retards, instead of increasing, the drying quality, it causes cracks and blisters, and above all, it proves very destructive to the paint itself.

The quality of patent driers varies very greatly, some of the cheaper grades consisting largely of material which possesses no drying properties whatever. Indeed, at the present day there is so much patent driers on the market that is largely adulterated that the author prefers to always use liquid driers, provided, of course, that its good quality has been clearly established. When the latter is used the proportions can very readily be ascertained and the danger of using an excess is avoided.

Another effect of using driers in excess is a somewhat peculiar one, and is worthy of mention here. The paint dries hard in rather less than the usual time, but after a week or two it gradually becomes soft, adhering to the hand or anything placed against it. The reason for this is that the paint dries only on the surface, owing to the excess of driers, and that the soft paint afterwards works through.

Pigment and Thinners.—It being now clearly understood that a paint consists of pigment such as white lead, mixed with oil in order to bind the particles together, and thinned with turpentine in order to render it of a suitable consistency for application by means of a brush, we may add a few remarks under each of these heads.

Pigments.—The principal pigments used by the painter are, as already stated, white lead, zinc oxide, oxide of iron, and the various colours used for tinting purposes. White lead is manufactured either by what is known as the "old Dutch" process, also known as the "stack" process, or by one of the many new methods which are designed to effect a saving of time. Speaking broadly, the old Dutch process yields the best lead, although there are one or two exceptions, notably Brimsdown lead, which is manufactured by a new

process. It is a beautifully white and fine lead which is rapidly gaining great popularity among painters.

Genuine white lead, *i.e.*, lead which is not adulterated, is always marked on the package, "Genuine White Lead." If any proportion of adulterant is added, the package is then marked, "Reduced White Lead," so that the reader need have no hesitancy in purchasing lead, because the mark will tell him what its quality is. If any merchant or manufacturer sells adulterated white lead as pure, he renders himself liable to heavy penalties for contravening the provisions of the "Merchandise Marks Act," and the White Lead Corroders Section of the London Chamber of Commerce order prosecutions in cases of the kind which come to their knowledge.

Zinc Oxide has, in recent years, made great advances in popularity among painters. Compared to white lead, it is as white to yellow. It is indeed beautifully white, very fine, and easily worked. The whiteness is of importance in mixing paints, as the purity of the colour is retained, while when mixed with lead the yellowish cast to some extent destroys the purity of the original colour. The fact that oxide of zinc is non-poisonous is a point in its favour of very considerable importance. It is claimed that painters who take care to wash themselves frequently are not likely to contract lead poisoning. This is doubtless true enough, but as a matter of fact, the best of painters are at times careless, while in the rush of work, it is often impossible to take the precautions required.

There is one point about the use of zinc oxide which must be very clearly explained. Zinc oxide is, when compared with lead, quite light in weight, or, in other words, its volume is much greater than lead. Now, it being an entirely different product, it must not be treated in the same way as lead would be. The painter, perhaps, takes some zinc, mixes it with raw oil, with a liberal amount of patent driers and a more

liberal dose of turpentine, and then he grumbles because it does not show up to advantage. What he does is to destroy its inherent good qualities. To repeat then, zinc oxide must *not* be treated in the same way as white lead. Anchovy sauce is excellent for fish, but would be rather distasteful with a chop or steak. So with these two important white pigments.

The proper way to treat zinc oxide is to mix it with refined boiled oil, *i.e.*, cobalt driers should be used, and only just sufficient turpentine to bring it to the required consistency. Refined boiled oil may be had without difficulty from a number of makers. Being pale, it does not destroy the whiteness of the zinc, while it certainly aids considerably in drying. It is paler than raw linseed oil, and hence it does not destroy the most delicate tints, however light. It will be observed that the words "zinc oxide" have been used in the above paragraphs instead of "zinc white," the term by which the pigment is usually known among painters. The reason for this is that the latter term is not infrequently applied to an entirely different class of pigments of which Orr's white, Charlton white, and lithopone are the best known examples.

White Lead and Zinc Oxide Mixed.—In an address delivered by Mr. John Dewar before the International Convention of Master House Painters and Decorators Association of the United States and Canada, he said :—"One of the strong virtues of white lead and zinc oxide as paint pigments is that they absorb and retain the oil, each grain and atom becomes thoroughly saturated and each making strong the inherent weakness of the other, while the inert pigment is being simply immersed. The result of the two conditions can be readily understood, especially their position and action in a paint exposed to exterior climatic conditions for any length of time.

"These two pigments, white lead and zinc oxide, in combination, say, about 75% lead and 25% zinc, gives the ideal paint film. In combination, the weakness of

the one is made strong by contact with the other, the lead being of a coarser grain, the zinc being a fumed product is exceptionally fine in texture, filling the voids existing between the coarser particles, producing an impervious film. This combination is used very generally by me and is found satisfactory.

"In operating at or near the sea, or in the Southland of our country, owing to a substantial climatic difference, I change the formula to about 50% lead and 50% zinc. I find this wears very well indeed.

"For the priming of new wood I very frequently find it advantageous to use the lead alone, but for all subsequent coatings on new and old work I would earnestly recommend that the paint base be in the same proportion, so that there may be no unequal strain of the metals when expansion and contraction takes place by reason of heat and cold. Ochre should never be used as a priming coat."

TITANIUM WHITE is the latest addition of importance to the list of white pigments at the service of the painter, and is a pigment of great interest. It is a compound of the little-known metal, Titanium, and is derived from an ore called Ilmenite, which occurs in abundance in many parts of the world, particularly Norway. For a full account of the preparation and properties, see a paper "The Production of Titanium Oxide and its Use as a Paint Material," by Noel Heaton, in the "Journal of the Royal Society of Arts," May, 1922.

Unlike lead and zinc, the metal titanium itself is so little known in commerce that the name "titanium," although familiar to every student of chemistry for over a hundred years past, conveys nothing to the decorator, who is consequently liable to think that it is merely a fancy name, on a par with the many proprietary names of pigments and paints offered to the public, which are merely mixtures of the well-known materials derived from lead and zinc, already described. It should, therefore be clearly understood that titanium white is quite a distinct chemical substance, having substantially different

properties from either white lead or zinc oxide.

One property which appeals to every user is that it is absolutely non-poisonous. Mr. Heaton, who was one of the first to realise the industrial properties of this material and has carried on extensive researches on its properties during the past five years, has demonstrated its harmlessness in a convincing manner. Having convinced himself as to its non-poisonous nature from practical experiments on animals, he put his conviction to the test by making a meal of it. For this purpose a pound of dry pigment was made into a sort of porridge, with a little milk and sugar, and deliberately eaten. The progress of this remarkable meal through the body was watched by means of X-rays, and a series of photographs taken. This risky experiment, which involved saturating the digestive organs with the pigment for forty-eight hours, did not have the slightest ill effect on the health of the operator.

From the practical point of view the great value of titanium as a painters' material is that it combines an almost unbelievable body or opacity with great spreading power. Its obscuring power is practically double that of white lead, a fact which renders it supreme for covering a surface with a minimum of coats. Thus, it is particularly useful for undercoatings, especially undercoating for enamels, where, owing to the necessarily small amount of pigment in the finishing coat, one depends on the undercoating for bringing the surface to a level uniform colour. Similarly, in re-decorating, where the colour scheme has to be changed from dark to light, complete obliteration of the old colour can be accomplished more efficiently and with fewer coats with titanium white than any other white pigment known. As an actual example, two adjacent rooms in a house, one painted white and the other dark chocolate, were required to be thrown into one and the whole repainted cream. This was done with titanium white in two coats over the old paint, and it was impossible, except on the closest inspec-

tion, to detect where the original painting was brown and where white.

Connected with this remarkable obscuring power is the fact that titanium has an unrivalled power of reflecting light—it is valuable, therefore, for painting ceilings and dark corridors, especially as it is extremely resistant to discolouration.

Titanium white is not so satisfactory for producing high gloss finishes as zinc oxide, although a combination of the two produces a very good gloss. By itself it is seen at its best in flat finishes. In flat enamels and wall finishes for example, it more readily gives a uniform soft surface, free from any tendency to flash or shear, than any other white. In tone, titanium white is slightly on the warm side, having a slightly reddish cast in contradistinction to the yellowish cast of white lead or the bluish cast of zinc. Unlike white lead, which is very sensitive to discolouration in impure air, owing to the action of sulphur gases, titanium retains its brilliant whiteness under the most severe conditions of exposure. On this account it is eminently suitable for the painting of chemical laboratories, gas works, and similar situations where resistance to chemical fumes is essential.

Titanium White is what chemists call an "inert" pigment, that is, it can be mixed with other materials without any action taking place between them. It can, therefore, be mixed with any stainers without harm, and on account of its great reflecting power it forms brilliant and pleasing tints of any desired tone and strength when small proportions of stainers such as sienna, ochre, chrome, yellow, ultramarine, etc., are added to it.

Unlike lead, titanium has no drying action on the oil with which it is mixed; paints made with it, therefore, dry rather slowly, but this can be easily adjusted by using a rather higher proportion of driers. For instance, if a paste drier were used and 4 lbs. to the cwt. were required with white lead, the same drying time would

be obtained by using about 5 lbs. with titanium. The difference, as a matter of fact, is partly accounted for by the considerably greater bulk of titanium, weight for weight. A gallon of titanium paint for instance, ready mixed for use, will weigh only 16 to 18 lbs., instead of 28 to 30 lbs. as with white lead. This is a point that has to be borne in mind when considering the question of cost—when purchased by weight titanium sounds more expensive than other pigments, but when one considers that owing to its lightness only about two-thirds the quantity is required to cover the same area, it is really more economical in use.

In preparing paints for outside use it is generally found that a mixture of pigments is more durable than any one pigment used by itself. Titanium is no exception to this rule, and it is found that for our own climate a mixture of three parts of titanium white and one part of zinc oxide forms the most satisfactory combination. Paint made with this combination has a peculiar property of wearing entirely from the surface. As a result it commences to "chalk" on exposure, rather early, but such chalking does not indicate a general destruction of the film. It is confined entirely to the surface and the result of exposure tests over a long period shews that this chalking does not indicate any lack of durability. On the other hand it has two decided practical advantages. In the first place it has the effect of keeping the surface always clean and bright, and secondly, the wear being entirely from the surface, when the paint finally loses its vitality, after some years' exposure, it leaves the surface in an excellent condition for repainting, free from cracking or peeling.

Timonox.

Since the last edition of this book was published, a very important white pigment has been further developed and marketed under the above name. It has been very successful and bids fair to become even more so in the

future. It is manufactured by the Cookson Lead and Antimony Co., Ltd., Milburn House, Newcastle-on-Tyne, and is a fume product having a composition of 99-100 per cent. of antimony oxide.

The staining power is given as twice that of chamber white lead, three times that of stack lead and is 33 per cent. greater than zinc oxide. The spreading rate is intermediate between white lead and zinc oxide. The specific gravity is 5.73 and 112 lb. bulks, 1,954 Imperial gallons. The texture is exceedingly fine, being only slightly inferior to that of the best zinc oxide.

The drying properties are somewhat slow, but when Timonox is blended, as it usually is, in the preparation of ordinary paint with zinc oxide and barytes, it is more normal. The driers recommended are manganese or cobalt, the latter in preference. A combination of manganese and cobalt is particularly effective. A convenient manner of applying this combination is to use a good paste drier containing manganese and to add cobalt linoleate terebine when breaking down. Lead driers alone have no drying action whatever and resinate of cobalt should not be used as it makes the paint film brittle and shortens its life.

The paint film of pure red star Timonox yields a film very elastic and soft. When blended with zinc oxide, the drying is much accelerated and the film is harder. It is thus possible to modify the hardness and brittleness of a zinc oxide paint film by the introduction of Timonox and to obtain any intermediate degree of hardness desired.

It will be interesting to give the results of some exposure tests which have been made with this material. Three coats were given and these were exposed in a bad industrial atmosphere, the results being as follows :—

1. The pure "Timonox" gave a very durable film, and at the end of five years' exposure, the paint was still in good condition, but exhibited a tendency to "yellow."

2. When 10 per cent. or more of zinc oxide was added, the yellowing was prevented.

3. "Timonox" alone was discoloured by sulphuretted hydrogen, but when zinc oxide was present, this discolouration was prevented, the reason being that zinc oxide shows a preferential absorption of all sulphur acids when present in the atmosphere.

4. The addition of barytes in the proportion of from 30 to 50 per cent. showed a marked improvement in the condition of the film as compared with similar blends in which it was not used.

5. It was demonstrated that the oil content of a paint made from Timonox should be kept low, similar to white lead, as high oil content such as used with zinc oxide results in cracking after an exposure of from 12 to 18 months.

6. Timonox paints show particular good results in keeping down rust when used on iron work.

The following formulæ are recommended :—

No. 1 making an excellent paint for indoor decoration and No. 2 a useful general purposes paint :—

	1.	2.
Timonox Red Star ...	35	35
Zinc Oxide	35	15
Barytes	30	50
	100	100

In letting down "Timonox" White, ground in oil, the same quantity of fillers and driers should be used as with white lead. But a strict adherence to the figures given below eliminates all uncertainty and the resulting paint will be found to give perfect results. If considered slightly round, they may be thinned by the addition of a little turpentine or white spirit.

The Cobalt Linoleate Terebine referred to below is a strong one, containing 1.6 per cent. Cobalt Oxide.

Figures indicate parts by weight.

	Priming.	Bodying or Second Coat.	Glossy Finish.	Flat Finish.
Timonox White Paste	400	400	400	400
Non-setting Red Lead	6	—	—	—
Paste Driers ...	4	—	—	—
Cobalt Linoleate Terebine ...	6.5	5.5	7.0	2.5
Refined Linseed Oil	49	35	11	7
Pale Boiled Oil ...	—	—	44	—
Turps or White Spirit	11.5	24.5	15	61.5
	477	465	477	471

THINNERS.—Linseed oil is the principal vehicle used by painters. It is expensive, but no other oil can compare with it for good service. It is used both raw and boiled. Sometimes a proportion of each is used in paint. Boiled oil is linseed oil, which has been heated to about 350° to 500° F. This causes the oil, when cool, to dry much quicker, but dryers are with the same object usually added while the oil is hot. Boiled oil should dry hard in about twenty-four hours, and a good test is to paint a little on a watch glass. At the end of twenty-four hours it should have dried quite hard. There is a great difference of opinion among painters as to the proper use of boiled and raw oils. Some prefer to use boiled oil almost always, while others are of the opinion that the less used the better. The author's opinion is that good boiled oil may safely be used if mixed with the proper proportions of raw oil,

depending upon the class of work to be done, and that this produces far better work than it is possible to obtain by the practice so frequently carried on of adding driers in excess to paint.

Turpentine.—A paint having been mixed by the addition of linseed oil to the paste white lead, colour, etc., must be further thinned in order to bring it to the proper consistency suitable for application by means of a brush. For this purpose American turpentine is usually employed. Elsewhere in this book will be found the proportion to be used for various paints, namely, those which are to dry glossy and those which are to dry flat or without gloss.

The turpentine soon evaporates and it is a debatable point whether the whole of it actually disappears or not, but the consensus of opinion is that very little, if anything, is left behind. The turpentine leaves behind the linseed oil and pigments which form the paint. The oil, by the assistance of the dryer, absorbs oxygen from the atmosphere and becomes hard.

American turpentine being very expensive, efforts were made to produce a substitute which would replace the genuine product as a thinner. These were successful, and White Spirit, which is now sold at a fraction of the cost of pure turpentine, was put on the market.

This White Spirit is of petroleum origin, and is made in several grades to suit the requirements of paint and varnish manufacturers.

But, to-day, there is another type of thinner procurable, to be used, not as a substitute for, but as an alternative to American Turpentine. This material has the same flash point and drying properties as the genuine product, and can be used in its place in all paints and varnishes.

The alternative material in question is known as Decco Turps, and is manufactured by Messrs. Glico Petroleum, Limited, Alexandra House, Queen Square, London, W.C.1.

It has been on the market now for a considerable time, has a large and steadily increasing sale and gives great satisfaction in all of the various uses to which it is put. Elaborate and carefully conducted tests have proved it to be the equal of American Turpentine in every respect, although its cost is considerably less.

SPECIFICATION FOR WHITE SPIRIT.

Those of our readers who have not yet obtained copies of the British Engineering Standards Association Specifications for paints, varnishes and paint ingredients, which have already been published, should do so without delay, as they will be found very valuable for reference. They may be obtained (price by post 1/2) from the Association, 28, Victoria Street, Westminster, S.W.1.

The specification just issued for white spirit provides in a scientific manner, for the tests which have been made by painters and others for a long time past, the chief of these are that the white spirit must evaporate in about the same time as genuine turpentine, should be water white and should be free from objectionable odour. The painter's further test is to drop a little of the white spirit on some paper side by side with a drop of genuine turpentine and to note the rate of evaporation, which should be practically the same in both cases. These tests, as already stated, are given in a scientific and practical form in the B.E.S.A. Specification. For instance, the material must be wholly a petroleum product, water white, clear, free from water and other visible impurities and from objectionable odour. The freedom from grease is to be ascertained by the sample passing the following test: No grease spot or mark shall be visible when about 0.5 c.c. of the material is allowed to fall in one place on a sheet of ashless white filter paper, and the paper is freely exposed to the air for one hour at a temperature of about 60° F. The flash point of the material (Abal's close test) shall not be less than 78° F. To test the rate of evaporation the following is provided as a method on termination of volatility: One gramme of the white

spirit shall be weighed into a watch glass or flat bottomed glass dish of about 3″ in diameter, and left exposed to the air in a room free from draughts, at a temperature of from 60-65° F. The loss in weight shall be determined at intervals and shall follow closely that of genuine turpentine, treated similarly and at the same time. At the end of 24 hours the residue remaining from white spirit shall not exceed 0.5 per cent.

The second specification on turpentine, by which is meant American gum spirits or spirits of turpentine, provides that the specific gravity of the material at 60° F. shall not be less than 0.862 nor more than 0.872 when compared with water at the same temperature. The flash point of the material (Abal's close test) shall not be less than 90° F.

Paint Mixing.—For ordinary quantities of paint, the following is the method usually employed in mixing. A can or kettle is most usually employed for mixing the white lead or other base, and this is first thinned out and mixed with the driers and oil, the colour being afterwards added to it. It saves time to well beat up the lead with a wooden spatula, shaped like an oar or spade, before adding thinners of any kind. This having been done, a little oil is first placed in the can, which is twisted around so that the oil covers every part of the inside surface. This prevents the lead sticking against the tin. A sufficient quantity of oil and the patent, or other driers, is then added. The lead is

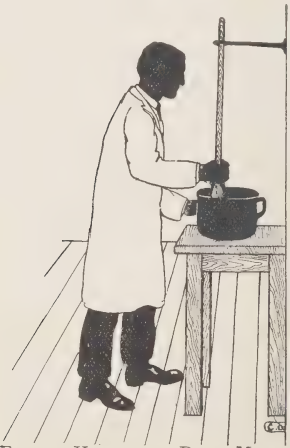


Fig. 1.—Home-made Paint Mixer.

stirred and beaten against the sides of the tin until the whole is of the same consistency, and more oil is added until the thickness is not sufficient to support the stick standing upright. Turpentine may now be added to further thin the mixture, and then the colour is added. It may be noted here that the result is not so satisfactory if the turpentine is added before the oil.

A simple but effective home-made mixer for beating up lead is shown in the illustration. The leverage obtained by the simple means indicated greatly facilitates the operation. Messrs. Postans and Morley, of Birmingham, marketed an apparatus of this kind some years ago, the upright stick being a strong bamboo cane.

The best way of mixing tinting colours is to place them on a stone, thoroughly amalgamating one with the other by means of a spatula. When the colour is what is required it is added to the white. To take a simple case of a gray, a little black would be beaten up on the stone, and when quite thin added to the pot of white. This would then be stirred up thoroughly and the grey colour observed to see whether it was sufficiently dark. Then a very little red and blue might be prepared on the stone and this be added to the pot, the mixture being again stirred. Two very important rules must be observed at this point. The first is that the colours ground in oil should be used and not dry colours. If dry colours are employed, oil must be added to them on the stone and not in the pot. We may repeat, by way of emphasis, that under no circumstances must dry colours be added to the pot of colour. This is a rule to which there is no exception. The second rule, and one which is equally important, is to add only a small quantity of colour to the pot of white at the time. Taking the case once more of the grey, a little black being added and the mixture well stirred, it can be seen at a glance whether the desired depth of shade is obtained. On the other hand, it would be quite impossible to take any of the

black from the mixture, and should it be too dark, the only way to lighten it would be to add more white, and this would probably mean mixing much more paint than was required for the job.

It will be understood that the above description of mixing refers to ordinary jobs such as are required in painting a house. When a considerable quantity of paint is to be mixed at the same time, a mechanical mixer may be used with great advantage. It is remarkable that painters do not use these paint mixers more frequently. They certainly effect a great deal of saving of time, and the outlay of a few pounds would be quickly repaid.

Since the earlier editions of this book were published, in which it was recommended to use a machine for mixing paints, considerable progress has been made in this direction and many contractors now realise that whenever a large quantity of paint is to be mixed, it pays far better to use a machine than it does to use the old fashioned method. The author's opinion is that excepting, perhaps, in very small shops, it would pay every employing painter to purchase a good paint mixer.

PAINT MIXING MACHINES.—There are on the market several types of paint mixing machines. One known as the "Wee Macgregor" is represented in Fig. 2, and is suitable for painters' use. It consists of a cylinder which contains the paint, and in this are three bent knives or paddles. The handle attached, on being operated, turns the cylinder in one direction and the knives in the opposite direction, these knives in the meantime revolving around on their own axes. The paint is thus mixed very quickly, and as the cylinder may be had to hold $2\frac{1}{2}$ gallons, in the case of bridge work, wall work, or other positions where a very large quantity of the same paint is required, the purchase, for a few pounds, of such a machine may mean a saving of a considerable amount of labour.

HYGEIA FLAT WALL PAINT

PLATE III.

Selection from HYGEIA FLAT WALL FINISH range of Colors, by courtesy of Messrs. Pinchin, Johnson & Co., Ltd., London.

Fig. 3 shows a similar machine when the handle is thrown back which lifts the mixing blades out of the cylinder, leaving it free to be lifted in order that the paint may be poured out.

The mixers illustrated in Figs. 2 and 3 are manufactured by Torrance and Sons, of Bitton, near Bristol. In many shops, where large quantities of stone colour and other paints have to be turned out, such a machine

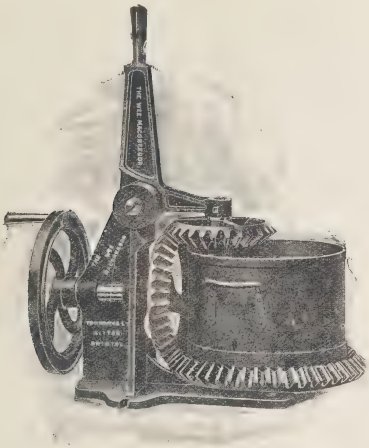


Fig. 2.—The "Wee Macgregor" Paint Mixer.

would soon repay its cost. As they are light in weight they could easily be moved from job to job.

The paint mixers above mentioned, although excellent of their kind, are not quite suitable for mixing very small quantities of paint or colour, and they are also almost too expensive for a small painter's shop. Messrs. Torrance and Sons, Ltd., have, however, recently brought out another mixer.

The "Baby Twin" mill was designed to meet a demand for a small mill capable of dealing with the many small orders for paints and enamels which the paint manufacturer has to contend with.

The rolls are of special chilled metal, the fast-running roll is arranged for water-cooling, and the machine is fitted complete with the necessary gun-metal water fittings and regulating valve, so that only the water feed

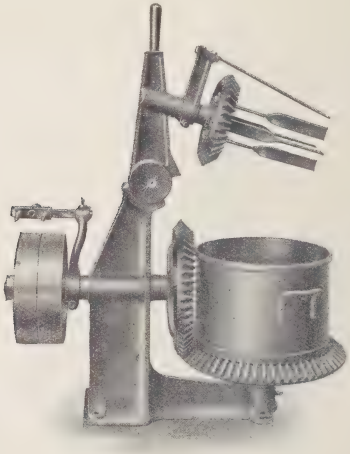


Fig. 3.—The "Little Giant" Paint Mixer.

pipe requires connection to the valve and a drain pipe for the waste water screwed into the cup at the bottom. Water-cooling is necessary when grinding materials in volatile mediums, but for ordinary soft pigments in oil is not generally necessary.

The mill is fitted with spring-controlled micrometer roll-adjusting mechanism which ensures the finest possible grinding and large output with low power consumption,

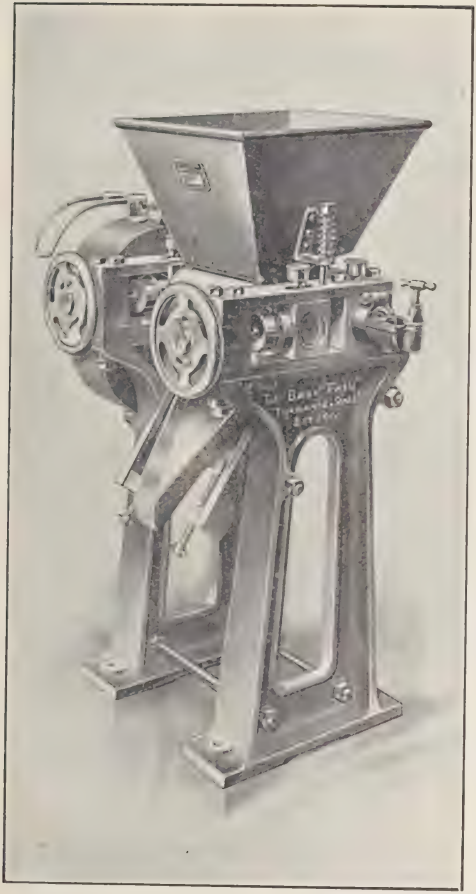


FIG. 4.—THE "BABY TWIN" MILL.

and enables the rolls to be instantly set parallel, ensuring the same consistent grinding from end to end of the

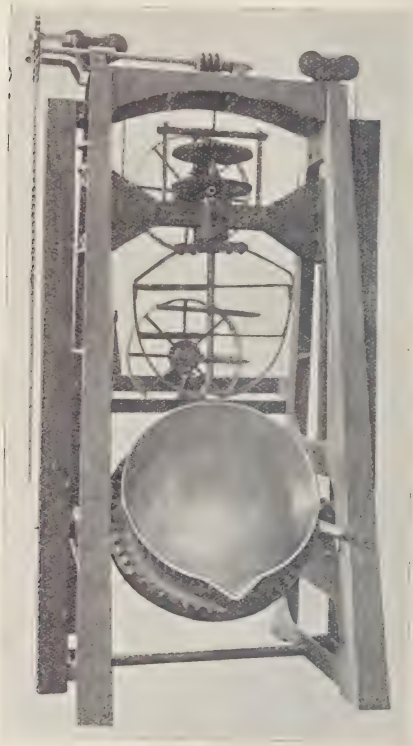


FIG. 5.

TILTING STEAM HEATED MIXERS WITH NICKEL INNER PAN, SHOWING TWO METHODS OF LIFTING THE MIXING KNIVES OUT.

roll and maintains the truth of the rolls indefinitely. When the zero mark on the calibrated rings is registering

with the pointer, the rolls are just touching but not frictioning hard. If the hand-wheels are turned in a

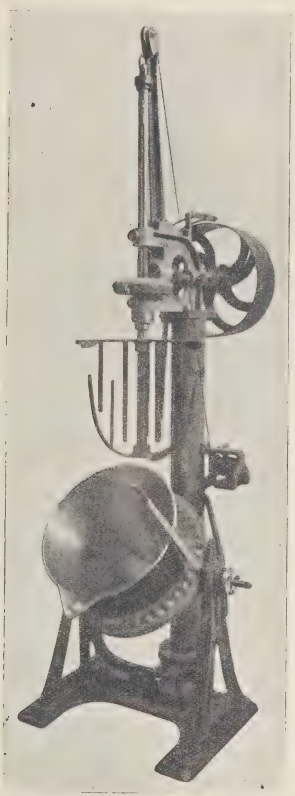


FIG. 6.

right-hand direction, past the zero mark, the "pressure" calibrations are brought to register with the pointers in

the ends of the caps of the frames. Each of these divisions represent a degree of pressure applied to the roll contacts. By turning the hand-wheels in a left-hand direction, past the zero mark, each division represents the rolls being divided one thousandth of an inch. These calibrations are stamped "clearance" on the calibrated rings.

Messrs. Torrance & Sons, Ltd., are the makers.

Fig. 5 illustrating nickel mixing pan. This machine is fitted with double motion stirring gear (supplied either in acid resisting metal or wrought iron), complete with lifting arrangement, the bridge piece of the stirring gear running on turned guides and balanced. Nickel inner pan fitted into cast iron jacket which is mounted on bearings for tipping purposes between massive cast iron "A" frames. The machine being practically fool-proof, as the belt is left on the loose pulley whilst the stirrers are lifted out of the pan.

Fig. 6 shows nickel stirring and tilting mixer fitted with stirrers which have the same effect as a double acting stirrer though only one of the sets of blades actually move; the other set is stationary, and has dependent fingers which interlace with those that revolve. These stirrers can be supplied in acid resisting metal or wrought iron. When tilting the mixer for emptying or cleaning purposes, the stirrers can be lifted out of the pan by means of a small winch which is fitted to the machine.

The paint mixer, illustrated in Fig. 7, is different in construction from those illustrated elsewhere. It is called "The Mix-ap," and was invented and is manufactured by George Whigelt, of 3, Cedar Street, New York. Two outstanding features of this mixer should be referred to. First, that by changing the crank handle, either a paste or a liquid can be mixed, the gear regulating the rate at which the paddles are revolved. Four of such paddles, each of them being perforated and of special shape, are supplied with the machine, but only one of these is needed for the operation of mixing, its size

depending upon the size of the container and the consistency of the material to be mixed. Each propeller is held in its place on the vertical shaft by means of a thumb screw. The speed with which the mixer works will be understood when it is said that 100 pounds of lead can be mixed with the necessary thinner in from eight to ten minutes, and lamp black or any other paste colour can be mixed with ready-mixed white lead in less than three minutes. The machine is easily cleaned and is sold at a very moderate price.

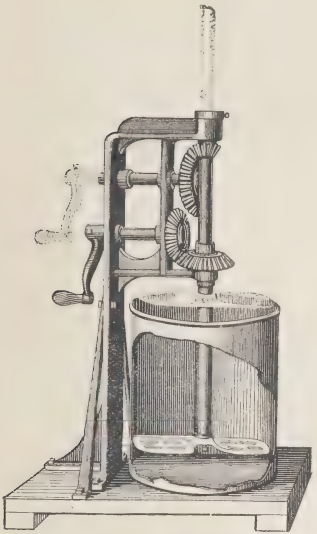


FIG. 7.—THE "MIX-AP" PAINT MIXER.

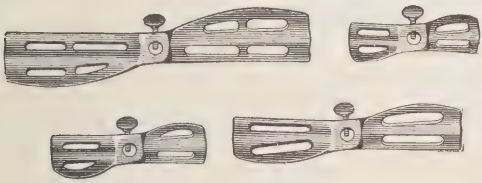


FIG. 8.—DIFFERENT SIZED PADDLES.

CHAPTER II.

The Proportions of Pigment and Thinners in Paint.

The business of making and applying paint may not yet be considered an exact science, but at least it can be said that it is governed by certain basic principles, and these must be observed if success is to be attained. There are certain definite limitations in the proportions of the various materials which go to make up a paint, and it is within such limits that safety must lie. To such an extent do these limitations apply that an experienced observer can tell within a narrow margin what the behaviour or life of a paint may be, under certain conditions, simply by examining the formula from which the paint is made up.

There are two factors that must guide the paint maker before every other consideration. The first is the practicability of the paint he has made, for it is obvious that no matter how fine or how pure a paint may be, it is not a practical proposition if it cannot be applied successfully and by the ordinary methods used by the average painter. The second is the suitability of the paint for the purpose intended. With regard to the practicability of the paint we have all experienced the fact that an impossible paint can readily be made from pure materials. The paint may be unworkable when first made or it may have become so through storage. This is a point that the paint manufacturer has to watch far more closely than the paint maker, who makes up the paint on the job for immediate use, needs to do. It is a point which has led many painters to adopt, in the place

of a ready-for-use paint, one which is nearly so, but capable of final adjustment. Any adjustment made by the painter must be made in such a way that the quality of the paint is not impaired and he should be given definite instructions upon this point.

The question of the suitability of the paint for the purpose intended is, perhaps, the most important of all, and it is difficult to understand how a paint maker can fulfil his mission with any degree of success unless he understands fully the laws which govern the application of paint and the relations which must exist between the various applications and also between them as a whole, and the surface to which they are applied. Without such knowledge he blindly follows the formulas prepared by others. Having determined the exact qualities requisite and made them up on the most approved methods, the question of application may be undertaken either by himself, if he be a practical painter and has the time and facilities for so doing, or by a practical painter employed for the purpose. The latter is much the better plan, for it is against human nature that we should be too critical of our own productions.

What, then, are the principal attributes that a paint should possess ?

They are many and varied as the following will show. No single type of paint could possibly fulfil all the requirements and it is a general rule that no two succeeding coats of paint should be exactly alike. There is one big exception to this rule and it concerns the use of semi-gloss or semi-flat coatings. These lie midway between gloss and flat, and are equivalent to the painter's "second-colour," or what the painter often terms "half-and-half," because it is made by the addition of oil and turps in equal proportions. This type of paint may be duplicated for two or more coats with success, but with nearly all other types the succeeding coats differ in character and composition. An oil paint or gloss paint is generally applied over a flat ground coat, while a flat paint finds its greatest success

over an oily paint undercoat. The reasons for this rule and the exceptions to it will be explained later.

As an example of the differing character of succeeding coats we will take the well-established four coat process of painting used on woodwork. By members of the painting trade these coats are usually referred to as—

(*a*) Priming.
(*b*) Second Colour or Second Coat.
(*c*) Ground Coat or Ground Colour.
(*d*) Finishing Coat or Finishing Colour.

The priming coat, generally made from white lead tinted with red lead, is a fairly thin oil paint intended to enter the grain of the wood as far as possible, and to "set" the grain so that it can be sandpapered smooth.

The second colour is made from white lead, thinned with equal proportions of linseed oil and turpentine. It is kept well on the stout side, that is, there is a high proportion of white lead present, and it is intended to be well brushed out and left fine under the brush. Its mission is to even up the rather uneven surface produced by the priming owing to the presence of hard and soft grain in the wood, no absorption at all on the knots which have been shellacked and so on. A good coat of second colour acts partly as a filler, and it presents a good firm foundation for the third coat or ground colour. The ground colour (third coat) may be either a flat paint or an oil paint, according to whether the finishing coat is to be an oil paint or a flat paint, and it is to be observed that the second colour by reason of its composition, will accept either the oil or the flat with equal facility. A flat ground coat is applied if the finishing is to be an oil paint, and these coats should be approximately of the same shade. There are exceptions to this also, and these will be stated at a later stage. An oily ground coat is applied if the finishing is to be a flat *paint*, but not if the finish is to be a flat *enamel*.

Here, then, we have in a single painting operation, four different types of paint to deal with, and their composition

varies to such an extent that it would be impossible to make them all up from one basic material unless it is a paste capable of receiving at least 25 per cent. (by weight) of thinners. Neither is it merely a matter of thinning the paint to obtain certain results. There is also the question of drying to be considered. Driers must be added to speed up the oxidation of the oil, and the percentage of driers added usually depends upon the percentage of oil present. It also depends upon the condition of the surface to which the paint is to be applied as well as the general atmospheric conditions prevailing at the time of painting. It is clear, therefore, that the proportion of driers must vary from time to time. There is a tremendous difference between applying a coat of oil paint upon a nice fresh ground of flat colour and, for example, direct upon an exterior compo front of a house. There is a safety limit for driers, and beyond that limit in proportion to the rate at which they speed up oxidation, they hasten the disintegration of the paint film. The paint that is made to dry well on a sulphur-laden surface would not be an ideal one for finishing. Hence the reason for the adoption of a two coat painting process even where a single coat might answer so far as opacity is concerned. It could be done, but it is not practical; it does not conform to one of the basic principles of painting.

How then is the paint mixer to deal with this question of driers? If he knows exactly to what use the paint he is making is to be put, and the probable conditions prevailing, he will be able to adjust the paint accordingly. Too often, however, he has no such knowledge, and must be guided by the law of averages and keep as near to the safety line as possible.

The most reasonable way to deal with the question of driers would be to first determine the minimum quantity required under normal conditions, to add same to the oil or in proportion to the oil present, and then to provide the painter with definite instructions as to the necessity for adding a further supply of drier to meet any special

or abnormal conditions. There is something to be said for this method apart from the fact that the painter is in the best position to know what the conditions are. Driers often have a way of losing their power in course of time and the addition of a minute percentage of fresh drier will work wonders and especially if the drier that is added is not the same as that present in the paint. We will assume that in the paint, when it is made, is put the normal percentage of patent driers (probably acetate of lead, etc.), equivalent to 12½ per cent. on the oil, or 5 per cent. (five per cent.) on the finished paint. In course of time the drying slows up when the conditions are bad. The addition of a minute quantity of a manganese cobalt drier would, after being allowed to stand in the paint a few hours, restore and increase the strength of the original drier, while the adverse effects would be slight compared with an equivalent addition of driers in the original mixture.

We may now consider the limitations imposed upon the other ingredients. Paints intended for everyday use may be divided into 3 main groups: flat paints, including flat undercoats, oil paint, and semi or half-and-half paints.

The determining factor between these is the proportion of oil to spirit (*turps or white spirit*), *while the determining factor between coatings of a similar type, but used for a different purpose, is the proportion of pigment to vehicle* (*thinners*). As an example of this, an oil paint may be used as a priming or as a finishing coat. In each case the proportion of oil to spirit may be the same, but for the priming there will be less pigment than for the finishing, or to put it in another way, the priming paint will have a higher percentage of thinners.

If we look at paint mixing from the standpoint of the above statement, coupled with the remarks upon driers, the production of any given type of paint becomes a fairly simple proposition. Here are the limits within which we may safely proceed:—

Pigment:

White lead paste may be from 60% to 80% of the paint by weight;

Vehicle:

Linseed oil (raw) ,, 4% to 30% ,, ,,

Turpentine (or white spirit) 5% to 20% ,, ,,

according to whether you desire a flatting paint on the one hand or a thin oil paint on the other, or something midway between the two. The balance between pigment and vehicle can only vary to the extent shown by the above figures, viz.:

Pigment (paste)	60%	to	80%	by weight.
Vehicle	40%	to	20%	,,
Total	100%		100%	,,

There is one fact to be remembered, that turpentine has a greater fluidity than oil and therefore as the proportion of turpentine increases (as in flatting) so must the proportion of pigment to vehicle increase. As an extreme case take the making of a flatting paint. The figures would be :—

White lead paste	80%
Turpentine (and drier)	20%
Total	100%

This is the highest proportion of pigment in any type of lead paint, or indeed, in any type of paint, because white lead has the highest specific gravity of all white pigments. For a well bound flatting the figures would be :—

White lead paste	78%	=	Pigment 78%
Turpentine (and drier)	17%		Vehicle 22%
Varnish	5%		
Total	100%		

For a semi-flat undercoat a flatting bound with the finishing paint or enamel would be of the following proportions :—

White lead paste	75%		Pigment 75%
Turpentine (and drier)	15%	=	Vehicle
Gloss paint or enamel	10%	+	Enamel 25%
Total	100%		

For second colour or half-and-half, we have equal quantities of oil and turps added, and the proportion of pigment to vehicle is the same as for flatting, but it produces a much better bodied paint because one half the quantity of turps is replaced by oil which has less thinning properties.

Second Colour :

White lead paste	80%		Pigment 80%
Linseed oil and drier	10%	=	Vehicle 20%
Turpentine (or spirit)	10%		
Total	100%		

For an oil paint for use as a finishing coat the proportions would be :

White lead paste	70%		Pigment 70%
Linseed oil (and drier)	25%	=	Vehicle 30%
Turps (or spirit)	5%		
Total	100%		

And for a thin oil paint for primings, etc., we reach our maximum of oil content (for *raw* linseed oil) :

White lead paste	65%		Pigment 65%
Linseed oil (and drier)	30%	=	Vehicle 35%
Turpentine (or spirit)	5%		
Total	100%		

When dealing with pigments other than white lead, the procedure is practically the same, excepting that the proportions will vary slightly with the specific gravity of the pigments and the percentage of oil required to bring them to a workable paste. The oil percentage may vary from 8 per cent. in the case of white lead to 20 per cent. in the case of zinc oxide, while the newer pigments, Antimony oxide and Titanium oxide come within these figures, but closer to the higher one. It is necessary to take into consideration the oil in the pigment paste in order to add sufficient driers to deal with it. In the case of white lead flatting, the oil in the white lead paste is the only oil present, so the added driers will be low. In the case of Zinc oxide it is difficult to make a true flatting, even with nothing added but turpentine, because of the 20 per cent. of oil in the Zinc oxide paste. This high proportion accounts also, to some extent, for the slow drying.

Taking all these points into consideration it seems to be quite clear that the most reliable way for the average paint maker to proceed is to first make up his vehicle by combining the oil, turps and driers in the proportions indicated for the type of paint to be made, and then take the pigment he intends to employ, and the vehicle he has made, in their respective proportions, and having mixed them in the most approved fashion, as recommended elsewhere, to test same for opacity and drying. Any adjustment in the way of extra thinners can then be made by an addition of more vehicle without in any way altering the character of the paint.

While considering the question of the suitability of a paint for some definite purpose or effect, we must not lose sight of the fact that there are certain characteristics which paints should possess, apart from their actual formula; certain niceties which are only revealed by actual use, the presence of which will stamp the paint with the hall mark of quality. To take as an example the making of gloss paints for fine finishing work. Paints may be roughly divided into two classes, the flowing and

the non-flowing. The latter type is a full pigment heavy paint that must be brushed out and fined down by lightly laying off with a fine bristled brush. The flowing type may be applied freely and spread evenly with a firm hand, then left to find its own level, which it will do if the paint is properly balanced. The flowing type is not a full pigment paint, the pigment content seldom, if ever, goes beyond 55 per cent. of the total formula. Thus we may have a vehicle content as high as 45 per cent. or 50 per cent. in a white paint, and even 70 per cent. in a coloured paint. In our table of limitations we gave 30 per cent. as being the maximum of raw linseed oil in a paint mixture. If we go beyond this figure we get a soft skinning paint, liable to shrivel and blister and not at all satisfactory for ordinary painting purposes, and especially when there is little or no absorption in the under-surface.

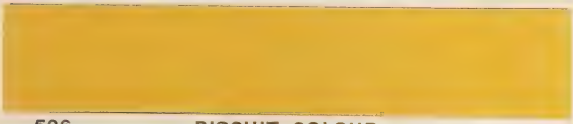
How then are we to deal with a paint which requires 70 per cent. of vehicle? Something other than raw linseed oil must be employed. For slow drying and super-elastic paints we may take a treated linseed oil of a specific gravity up to .960. For quicker drying we must use a suitable mixing varnish to reinforce the linseed oil. Mixing varnishes are to be obtained suitable for any purpose and any pigment. They usually have a low acid value and impart to the oil the strength that it needs to resist atmospheric influences. The addition of varnish should be made some days before the paint is used or a flatting effect may be obtained in place of the expected increase of gloss. Here again it is better that the whole of the vehicle be combined together before the paint is made.

If we examine different types of paint, even of the same colour, we may be surprised at the wide difference in the proportions of their make up, and although they may be intended for a similar purpose, their actual behaviour will follow closely their formula.

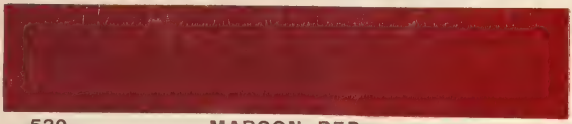
Here is an analysis taken of two samples of green paint, supplied for the same purpose :—

S.E.G. Super Elastic Gloss Paint.

502 STONE COLOUR.

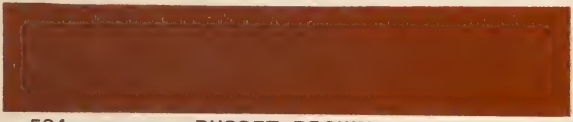


506 BISCUIT COLOUR.

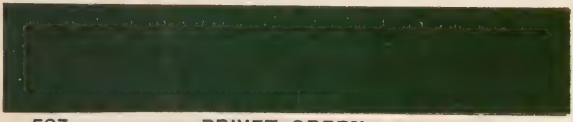


520 MAROON RED.

521 SIGNAL RED.



524 RUSSET BROWN.



537 PRIVET GREEN.

NAYLOR BROTHERS (LONDON) LIMITED,
SLOUGH, BUCKS.

No. 1 sample.

Green pigment	20%	(17½ Pruss. Blue, 2½ mid-chrome).
Vehicle	80%	(Mixing varnish).

No. 2 sample.

Green pigment	16%	(14 Prussian Blue, 2 mid-chrome).
Barytes	54%	
Vehicle	30%	(Boiled and raw oil and turpentine).

In the first sample there is only 20% of pigment, but the opacity was good and the flowing of the paint was excellent because of the high varnish content. In the second sample the opacity was also good because of the quantity of pigment left on the surface in spite of the fact that the proportion of actual colouring matter was less. The presence of a total of 70 per cent. of pigment, however, prevented the flowing out, and it was obviously a brushing out type. The first sample in which the pigment was protected by varnish kept its colour and gloss to a remarkable degree. The second sample soon lost its gloss, and the colour quickly changed to blue.

The general rule, therefore, in order to produce a paint of quality that will give good service is to reduce the pigment content to the minimum of pure colour, and to employ a vehicle which is possessed of good weather-resisting qualities. If you employ only linseed oil then you must increase the pigment content to the limits we have mentioned.

While better results may be obtained by adding a varnish to linseed oil than by using oil alone, the best way is, undoubtedly, to employ a varnish medium made for the purpose and one containing no raw oil at all or it will prove a weak link in the chain.

The use of raw linseed oil in a gloss paint makes application more unsatisfactory, because of its slowness in setting and consequent tendency to run.

Probably the best vehicle the paint maker can make

for this purpose out of ordinary everyday materials is the following :—

Vehicle.	Pale Boiled Linseed Oil	60%
	Hard drying Carriage Varnish	30%
	Turpentine	10%
	Total	100%

This vehicle would be useful for gloss paint, especially for colours where a high percentage of vehicle was required.

The need for special varnish mediums is shown in the making up of flat paints. As we have seen in the formulas already given, the paint maker using everyday materials is limited to about 5 per cent. of oil in a lead flatting and 10 per cent. in a Zinc paint. When a suitable varnish medium is adopted a higher percentage of binding material may be attained with an accompanying improvement in application, flowing and washing properties. The well-known flat wall paints obtain their qualities in this way. The varnish medium may be a combination of linseed and china wood oil strongly cooked so as to carry a high proportion of spirit without losing body, and the final mixture with pigment produces a flat finish in spite of 12 or 13 per cent. of oil being present. The reason no doubt is that a vehicle of this description holds the pigment in perfect suspension and there is no dividing up of the paint film after application to the surface. Not so with the flatting made with a lower percentage of raw linseed oil. In this type most of the oil that is present floats to the surface of the film and it takes very little to spoil the perfect matt finish.

This "floating" effect of raw linseed oil acts detrimentally in many ways. It is one of the reasons for not attempting to apply two successive coats of oil paint, unless some means be adopted to stop the cissing caused by the greasy exudation on the surface of the first coat of oil paint. It is principally responsible for white finishes

turning yellow. The only chance of success with raw oil is to have sufficient pigment present to absorb it entirely.

When boiled or treated linseed oil is substituted for raw oil, a little adjustment in the percentage employed is necessary, because boiled oil has a higher gravity and should be reduced with turpentine to approximately the gravity of the raw oil if equal brushing qualities are to be retained. Boiled oil has often been accused of causing blistering on exterior work, but this can only be true when it is used in excess. When reduced with turpentine, as suggested, it will withstand more heat than raw linseed oil, but if there is moisture in the wood to which it is applied, it is just possible that any vapour caused by the sun's heat may have more effect upon the boiled oil film simply because it is more moisture resisting.

The application of varnish is governed by the same laws as paint and other materials. The final coat must be tough, elastic and resistant to atmospheric influence, but the coats beneath, and especially immediately beneath, must be firm and hard before the final coat is applied, because they will then be deprived of the means of hardening by oxidation, and having dried soft, will remain soft, while the final coat through direct exposure, will continue to harden and contract, and cracking or crazing may be the result.

It is better to attain the necessary firmness in the undercoats by a maximum of pigment content than to try and force a maximum quantity of oil to dry with a maximum amount of driers. Hence the adoption of the "second colour" type of undercoat as the maximum of oil permissible. When dealing with graining colour and other types that have to be varnished and in which very little pigment occurs, some special precaution must be taken to ensure sufficient hardening of the film. Some raw oil is necessary in order that the colour may keep open sufficiently long to enable it to be spread and worked with the graining tools while the introduction of varnish is unsuitable because it has a tendency to cause the colour

to flow together and spoil the effect. The best corrective, because it may be used in a lower percentage, is a good drying goldsize, while an excellent hardener is found in fine sifted whiting. The whiting will also prevent any tendency to flow together. The varnish must be super elastic that is used over graining colour, but this is a matter which rests with the painter rather than the paint maker.

Colours that are to be varnished and that have a high degree of oil absorption, should not be ground in linseed oil for it is almost impossible to harden them sufficiently to form a satisfactory ground, and painters should be discouraged from using "stainers in oil" for this purpose. Special mediums should be employed such as those already mentioned.

Note on percentages, indicated thus—%

In the foregoing notes all reference to various mixtures and the formulas for same is expressed in percentage or parts of one hundred, and always by weight. In case any of our readers are not familiar with this method of working out formulæ, we will explain as briefly as possible.

The usual method of printing recipes, partly by weight and partly by measure, is a very unsatisfactory one, and is never followed in a paint factory. When you are told to take 56lbs. of white lead and 2 or 3 gallons of linseed oil, a pint and 3 gills of turpentine and so on, you would have the greatest difficulty in knowing beforehand how much to take of each supposing you required only 14lbs. of paint or you would have some difficulty in recognising the type of paint likely to be forthcoming.

The basic idea of working to a percentage is, that no matter what you adopt as the *unit* for your weighing out, the proportions of your paint will remain the same, they may be recognised at a glance, and you will be able with a few minutes' calculation to make up any quantity of *finished paint* you may desire.

Let us see how this works out in practice.

If we take the lb. weight as our unit, and weigh up any of the formulas given, we shall obtain a total of 100

lbs. of paint. If we required only 50 lbs. of paint, we simply divide our figures by 2. For 25 lbs. divide by 4, for 20 lbs. divide by 5, and so on.

If we wish to work with quantities under 7 lbs., we may take the oz. weight as our unit and the total of 100 ozs. will provide us with 6lbs. 4ozs. of paint. This can be divided up again for smaller quantities.

It makes no difference what unit we take so long as we have 100 of them (and they are all the same weight); they can be tenpenny nails or tin-tacks or any foreign metric system such as the continental kilo, etc. When you glance at a paint formula, printed in percentages, you realize at once what it represents; you see at a glance the relation between oil and turpentine, between these and the pigments and the proportion of driers to them all. If you weigh them up, with the lb. as the unit, you know when you reach the 100 lbs. that you have included them all.

A comparison between weights and measures and percentages will be useful to illustrate this point. The formula for second colour :—

%		Weights, measures.
80%	White lead paste	80 lbs.
10%	Linseed oil and drier.	1 gall.—1 3/16 gills.
10%	Turpentine	1 gall.—1⅓ pints.

There is no comparison in the ease with which the *value* of the figures expressed may be recognised.

Take as an example the question of adding driers to this paint. Looking at the percentage side we see that there are 10 lbs. of oil and in the white lead paste there will be approximately 7 lbs. of oil, a total of 17 lbs. of oil to dry. If it takes 12½ per cent. of driers to dry the oil, the total to be added will be 2 lbs. 2 ozs.

Now try and work out the quantity of drier to add to the right hand table of 1 gall. 1 3/16 gills, plus 7 lbs. in the paste lead, and you will find it rather complicated. To work to a combination of weights and measures, you must know the specific gravity of all your materials. If you weigh the pigment paste, the greater part usually of your paint, why not weigh the balance of the materials ?

CHAPTER III.

STRAINING PAINT.

The straining of paint is such an apparently simple and everyday sort of process, that it seldom receives a second thought, except from the few who are out to do better than their fellows, and to do it in the most efficient manner and in the least possible time.

The paint strainer may prove to be either a good friend to the painter, or a "pal" to the smudge pot, and a prolific producer of bad results, according to the discrimination of its choice and the manner of its use.

Paint, which for the purpose of these remarks, includes enamel and varnish, and all the various mixings of pigment and vehicle, may be vastly improved, or it may be absolutely ruined during the process of straining.

The object of straining paint is to free it from all particles which exceed a certain dimension, the maximum of size being determined by the bulk of pigment in use at the moment, and the surface to which it is to be applied.

For instance, a paint intended for rough exterior work need not be so finely strained as one which is to be used as a finishing paint on a staircase wall or a drawing room door. For the former, a mesh of 50 per inch would suffice, for the latter, 100 mesh would be none too fine.

For every kind of paint according to its composition and purpose, there is a strainer of the correct "mesh" through which that paint will pass by gravitation alone,

without the aid of brute force or the coercion of a paint brush.

The painter must first learn to recognise the correct mesh required to successfully strain the various mixings with which he has to deal. He must also understand that a paint strainer was never designed with the object of serving as a receptacle in which to break up dried skins and masses of pigment. He must realize the folly of attempting to push a one-inch piece of solid matter through a hole one hundredth part of an inch in diameter, the only result of which is to obtain some fine hard grit, and a choked strainer.

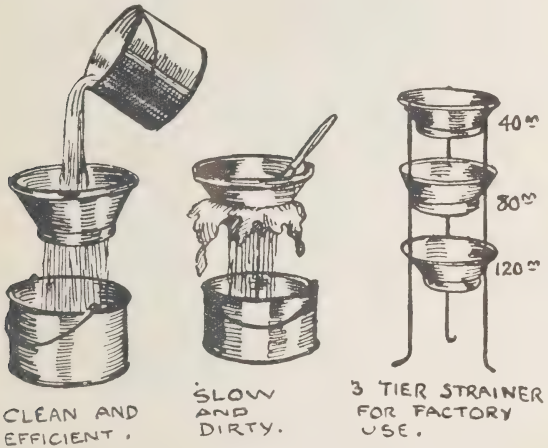


FIG. 9.—STRAINING PAINT.

One can hardly imagine a man in his right senses snatching a strainer, consisting of a portion of woollen underwear tied on a frame, out of a pail of dirty water, hastily scrape away some of the gritty exudations of the last operation, and calmly proceed to push through some white enamel, aided by a moulting, lousy brush. Yet we have seen it done. Not once, but many times. That

same man will turn round and say, "I strained it, and *then* it was gritty," and he is firmly convinced the material was at fault.

The operation of straining a pot of paint should be one of a few minutes only. If the paint is well broken up from materials which have not been allowed to dry up and waste, the simple act of pouring it through the correct meshed strainer is all-sufficient.

FIG. 10.—STRAINING PAINT.

When the paint is extra charged with skins, it is a great saving in time to use two strainers. The first could have a mesh of 50 per inch. This would catch all the skins and larger particles, and prevent the finer mesh clogging when the paint was passed through it

No brush need be used to aid its passage, but a square-ended knife should be kept handy for removing skins should they accumulate too rapidly.

There are two distinct types of straining gauze in general use, one of fabric, such as muslin, silk and stockingette, and the other of metal, such as iron wire, copper and brass gauze.

Of the fabrics, there is only one which we consider perfect, and it is sold under the name of "silk chiffon." It is even in mesh and free from fluff or loose particles. Owing to its price, however, it can only be looked upon as a luxury to be indulged in for the very finest gloss finishes. The method adopted by some of the super-

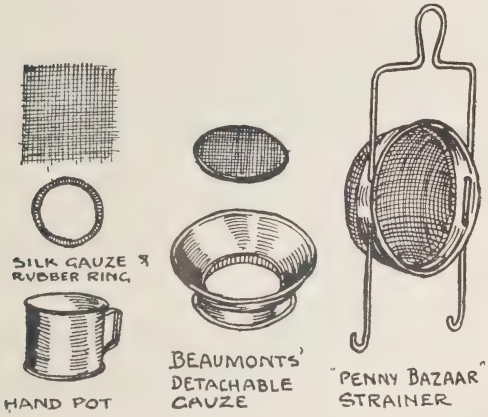


FIG. 11.—STRAINING PAINT.

coach painters will readily appeal to those anxious for perfection.

Sufficient material, whether it be enamel or varnish, to cover the job in hand is taken out into a hand pot, and covered over with a piece of silk chiffon, held in place by a strong elastic band (a cleaner and quicker method than tying with string). It is then poured out through the chiffon into a second pot, a small quantity at a time, from which it is used. This method prevents the

material getting gritty or fatty, and ensures a clean job, provided, of course, that equal care has been taken in other directions. When once used the chiffon is thrown away, hence its extravagance.

Of the other fabrics, a fine muslin is probably the best for ordinary paints, as being the most even in mesh and with most freedom from fluff. Any of the stockingette or woollen types are an abomination, and should not be allowed a place on the paint bench. One has only to handle a piece of this type of material in a strong light and note the quantity of loose fluffy stuff which

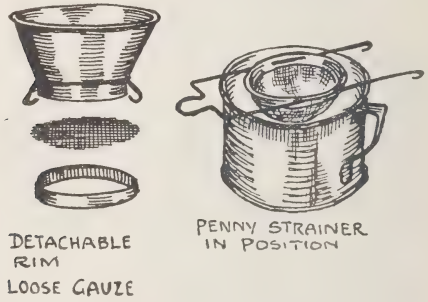


FIG. 12.—PAINT STRAINING.

floats away from it to realize that it is worse than useless, and a positive danger on a decent job.

The metal gauzes are far and away the most reliable as well as the most economical in use. They can be obtained in a variety of meshes and are particularly easy to keep clean. Those with a removable gauze are to be preferred, not only to facilitate cleaning, but because they enable the painter to vary the mesh at will to suit the job in hand.

Probably the best of these is one invented by Mr. Percy Beaumont. These are provided with removable gauzes which engage the frame in much the same way

as a lever lid is pressed into position. This provides a sound strainer with a perfect joint, and no fear of the bottom falling out with the weight of colour. Upon removal the gauzes may be thrown into a tin containing turps or paraffin, from whence they will emerge ready after a wipe over for any kind of colour.

This is claimed to be the best, strongest, and most advantageous paint and distemper strainer on the market, especially as a workman can use the refill for straining

FIG. 13.—THE BEAUMONT PAINT STRAINER.

purposes without the large cone at all for small quantities. The cone being seamless throughout, otherwise, stamped in one sheet of metal, there is no corrosion of paint anywhere, and the same can be burnt out at any time without fear of damage. It is sold in three sizes.

It is interesting to note that a most efficient little strainer may be obtained at the penny bazaars scattered throughout the country. They answer the purpose well for small quantities of paint or enamel, and should find a place in the kit bag of every well-intentioned painter.

Some enterprising British manufacturer would do well to develop this type in various sizes of frame and mesh. There is also the strainer with the loose bottom rim held in position by three clips. The gauze is inserted between the frame and the loose rim, and it offers the distinct advantage of adapting itself to any kind of gauze, either fabric or metal.

Two very useful little appliances of service to the paint mixer are shown in Figs 14 and 15. The first is an iron mixer, which possesses many advantages over the

FIG. 14.—IRON PAINT MIXER.

ordinary wooden paddle. The second consists of small attachments for a paint can, by which a piece of calico or other fabric may be kept in position for the protection

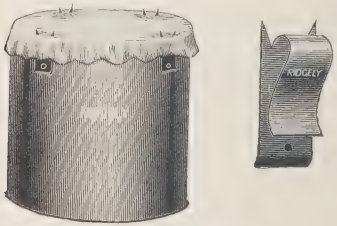


FIG. 15.—PROTECTING COVER FOR PAINT POT.

of the paint so as to exclude dust. Both are made by the Ridgely Trimmer Co., of 117, Clerkenwell Road, and cost but a few pence.

A useful form of stirring knife is shown in Fig. 16, and another form, made to shut up, for carrying in the pocket, in Fig 17.

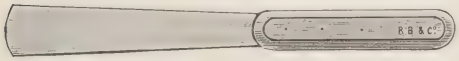


Fig. 16.

Fig. 17.

The long-handled brush, shown in Fig. 18, is useful for certain work, as for example, when painting the backs of

Fig. 18.

radiators, as well as for other work difficult to reach in the ordinary way. It is quite inexpensive, and is made in various forms.

CHAPTER IV.

Colours or Stainers.

We come now to a consideration of colours or stainers that have to be used in the mixtures given in the following chapters.

As a rule, one or several colours are added to the base, producing a tint, shade or hue as may be required. Sometimes, but not often, colours are employed as "body colours," that is they are employed just as they are purchased ground in oil, excepting that they are thinned down with the requisite quantity of oil and turpentine and mixed with dryers.

We may now give consideration to actual colour mixture, but must first make one or two points clear, so that the instructions which follow may be properly understood.

First, then, it should be said that colours vary in appearance according to the light in which they are viewed. For example, a colour, when looked at in the light of a sunny day in the open, has a very different appearance to that which it presents when viewed in a dark room. This will be explained at greater length further on. The mixtures here given refer principally to oil colours, and it must be clearly understood that the same results will not always be obtained with artists' water colours. In the case of the latter, tints are obtained by the addition of water just as they are produced in oil colours by the addition of white lead or other white pigment. Separate chapters on artists' water colours and water paints or distempers are included.

In examining the lists which follow, the reader may ask why we do not give the actual proportions of the different parts. The answer is that this is impossible for two reasons, the first being that colours vary so largely in quality that the proportions would be useless unless some particular make of colours was taken as a standard, while the second is that the names of the same colour vary also largely. Let us consider this point at once.

THE NOMENCLATURE OF COLOURS.—If half-a-dozen practical painters, experienced in colour mixing, were asked separately to mix a given colour, say a sea green, it is almost certain that when the six colours were compared there would not be two alike. Each of the six painters might have had precisely the same make of colours to work with, and yet the "sea green" would in each case be different. The explanation, of course, is that opinions differ as to what is a "sea green."

In giving the samples of colour which are contained in this work the author was, under the circumstances, somewhat puzzled to know exactly the right names to give each. His idea as to what was a bronze green, for example, might differ materially from the opinion of others, indeed, as it has already been explained, no two practical men would probably be found to agree as to the exact colour of two or three dozen differently named colours. Under these circumstances, he decided to follow what appeared to be the general rule in the trade. With this object he obtained the colour cards issued by all the leading paint manufacturing firms in the country, as well as some from abroad. He then took the colours which he thought would be most useful to his readers, and then very carefully, and with a considerable amount of labour, compared each colour with similar colours in the different colour cards, taking note of the different names which different manufacturers called them.

The result was very surprising, because it was found that in many cases there were as many names as there were manufacturers' cards represented. When, however, the same name was used by several manufacturers, that name was selected for the purpose of this work. The reader may, therefore, take it that the names employed here are those which are most general in the trade. As an instance of the variation of these names we may cite a few examples.

Bronze green was called by different manufacturers dark green, olive green, and sage green. In this case bronze green occurred more frequently than any other name.

Tea green was called also olive green and Queen Anne green.

Apple green was called very light sea green and Eau de Nil green.

Sage green was called also olive and pale Quaker green.

Venetian green was called also Imperial French green, light green, Shamrock green, bright green, mountain green, middle green, and engine green.

Light chocolate was called dark maroon, red lake, metallic brown, and in one case the sample given of burnt sienna was almost identical.

Olive green was called also sage green, deep olive green, and Quaker green.

Dark green was called also medium green, Brunswick green, middle green, and deep coach green.

Moss green some manufacturers evidently thought was the same thing as bronze green.

Pea green was called also sea green and Eau de Nil

Ivy green was called bronze green, sage green, Quaker green, olive green.

Slate was called also Quaker blue and dark lead.

Pearl grey was called also light grey.

Lilac was called also French grey.

MURALBO FLAT FINISH AND UNDERCOATING.

PLATE V.

ALSO IN WHITE, IVORY, CREAM, AND BLACK.

Warm grey was called also deep stone, French grey, and light stone.

Silver grey was called also lavender.

Steel grey was called French grey in several instances, but we prefer to use the other term, as it appears to be nearer to what is usually known in this country as a French grey, that is, one which has a touch of red and blue in it.

Another instance of the variation in the names of these colours is shown by light stone, which one would think was sufficiently well known to remove any doubt about it, but this was called smoke grey, French grey, and dove.

Middle stone was called also light drab.

Moss grey was called also silver grey.

Cream was called Manilla, light stone and deep deck.

Dark oak was called also dark drab and yellow bronze green.

Dove colour was called also deep stone.

Colonial yellow was called also straw, light stone, and deep cream.

Deep drab was called also dark stone, light drab, dark drab and fawn ; one sample of raw Turkey umber was almost identical.

Dark drab was given also as dark lava and middle drab.

Dark oak was called also copper brown, light oak, and Imperial brown, whilst in one case a sample of dark ochre was almost identical.

Deep cream was called also cream and lemon.

Primrose yellow was called also mustard yellow, canary and straw colour.

Straw was called also Naples yellow and deep Naples yellow.

Sandstone was called also dark stone.

Stone colour was called also ecru and light stone.

Smoke colour was called rustic drab and drab.

Signal red was called also vermilion, geranium red and poppy red.

Snuff brown was called also light brown, sepia, dark ochre, umber brown and Arabian brown.

Sienna brown was called also teak brown, coffee brown, deep Indian red and terra cotta.

Amber brown was called also bison brown, sepia, and dark oak.

Autumn leaf was called also leather lake, mast colour, middle oak, old gold, and light fawn.

Fawn brown was called light drab and light lava.

Light drab was called also middle drab and doe colour.

Buff in one case was called yellow ochre.

Acorn brown was called also umber, dark oak, dark brown, light brown, dark Indian brown, chestnut brown, middle chocolate, and Portland brown.

With the above instances before him the reader will not, we think, take any exception to the names we have chosen for our sample colours. The same is true concerning the instructions for colour admixture. If a reader makes a mixture according to those instructions and finds the result disappointing, the reason will probably be that his conception of the particular colour differs from that of the author, or it may arise from the fact that the colours used are of inferior quality. And it should be mentioned again, here, that every one of the mixtures has been made in oil colours, checked and checked again.

For many years past efforts have been made by scientists and others to formulate a permanent nomenclature for colours, tints, shades, and hues, but it cannot be said that so far any success has been met with. Should the efforts made prove ultimately successful, there is no doubt it would be a great boon to decorators, painters, and others; for example, if a decorator wanted to order from his manufacturer a certain tint or colour, all he would have to do would be to send

in the name. Prang, of Boston, in his work, "The Standard of Colour," endeavoured to systematise the subject, and he did this in the following manner. He produced sheets of colour divided up into several hundred squares. On the first sheet at the top was the spectrum of pure colours divided up, and beneath this, similar squares with similar colours, to which had been added a small portion of white. The line below this was the same again with more white added, and so on till the bottom of the sheet was reached, when the colours were greatly reduced by the white, the tints being naturally very light ones. The second sheet was exactly the same as the first, but a small portion of black had been added to all the colours and tints. The third sheet was the same thing again, with more black added, and the fourth sheet more black still, and so on to the end of the work. The colours were distinguished with letters, and the lines indicated the amount of white added by numbers. To anyone who possessed a copy of the work it would be a comparatively easy matter to order any colour from the book by number and letter, but the reader will readily perceive that this work falls short of the requirements of practical decorators, inasmuch as it does not provide for the admixture of different colours, but only those pure colours which are in the spectrum. It is true enough that all colours are as a matter of fact included in the spectrum, but it is not so easy a matter to separate them for practical purposes.

The variation in the names of colours above referred to has proved so inconvenient alike to manufacturers and decorators and other colour users, that an effort was made some years ago by a leading firm of paint manufacturers to remove the difficulty by standardising sixty of those colours which are most used. With this object, the firm in question offered prizes aggregating £100, and took a vote of several thousand competitors which included many eminent decorators

and colourists, besides architects, technical teachers and others. The firm in question was Messrs. Pinchin, Johnson and Company, Ltd., and the plan they adopted in carrying out their competition is worthy of record, because it demonstrates the value of the standard sheet so obtained. They first communicated with some 200 prominent decorators and other colour experts, and from them obtained a list of what was generally considered to be the sixty colours most in use. It may be observed here that there is no reason why sixty colours should have been taken any more than fifty or 100, but, obviously, the work and expense of conducting this competition was very great and it was necessary to decide upon some specific number, and it was felt that sixty colours standardised would mean, at least, a big step in the direction of a general colour nomenclature.

Having then settled as to which sixty colours should be included in their list, they next sent to everyone of the several thousands of competitors four painted samples of each colour or 240 colours in all. They also sent a sheet divided up into small squares, each square being printed with the particular name of the colour that was to be stuck down upon it. The competitor, therefore, was called upon to take any one colour, say sea green, and to select from the four samples of different shades or tints of sea green the one which in his opinion was best entitled to that name. This he stuck on the space allotted for it. He then proceeded to do exactly the same thing with the other fifty-nine colours and then sent the whole sheet to Messrs. Pinchin, Johnson and Company, Ltd. They employed a staff to go through each of these sheets to find out which of the four shades of different colour had received a majority of votes, and in this way evolved the winning shade—sixty of which formed the standard colour card.

The whole subject of Colour Nomenclature is dealt with in the next chapter, as well as the work done by a special panel appointed by the British Engineering Standards Association to select colours for ready-mixed paints.

THE ECONOMY OF USING GOOD COLOURS.—It may be taken as a safe rule for the painter to follow that where a good job is required the best materials only should be employed, but the reader may answer to this that the price paid to him for his work will frequently not permit of his doing this. We may leave the subject an open one which has really no place in these pages, except in so far as it relates to tinting colours, and here we can definitely and positively assert that it pays the painter best to use the best qualities of colour, quite irrespective of whether he gets a high price or a low price for his work. To explain: Let the reader assume that a large surface is to be painted a very light Prussian blue. The price for the work is fixed and the question to be determined is whether it will pay to use cheap Prussian blue or one of high quality. Assume that a high quality blue costs 3s. per pound, and that just one pound of it is sufficient to tint the whole of the white to the required shade. We are purposely giving a simple case so as to make the matter clear. Now a Prussian blue can be bought for, say 2s. 3d. a pound, but it would probably consist of at least one half of barytes or some other adulterant, which is of no value whatever as a stainer. If this colour is half strength it is obvious that two pounds of it would be required to tint the white for the work in hand, and this would cost 4s. 6d., against 3s. for the better class colour. This homely example should be taken to heart by every painter. He has only to experiment to find out that it never pays to use inferior tinting colours. Of course there is another reason why the best quality

should be used, and that is, the appearance of the inferior colours is always muddy and unsatisfactory.

HUE, TINT AND SHADE.—There is a good deal of confusion among some painters as to the meaning of the word "hue," "tint," and "shade," although there is no reason why any confusion should exist. The word "hue" is often employed to mean practically the same thing as a "colour," but strictly it means the particular cast or individuality, so to speak, of a colour. Thus we talk of a scarlet of a yellowish hue or a crimson of a bluish hue. A colour may consist of any mixture of other colours, or may be a pure colour itself. Now when white is added to any hue or colour a tint of that colour is produced. If black is added a shade of that colour is produced. In the decoration of our rooms we shall see that as an actual fact we obtain shades of the colour by the partial omission of light, because the addition of black as a pigment to a colour acts in the same way as shutting off light. In mixing colours it is important to remember that black should not be used to lower the tone of a colour excepting in rare instances. It only has the effect of producing a muddy appearance. A yellow that is too bright can be reduced, or made less staring, a painter might say, by adding a little blue and red. If a blue is too bright a little red and yellow should be added; or if a red is too bright it may be toned down by the addition of a very little blue and yellow. This is a most useful rule to observe, and as long as the quantity of the colours added is not too great, the results will please.

In practice umber is a most useful colour to employ for lowering the brilliancy of a colour, but only a small quantity is necessary for the purpose. If the requisite tone cannot be obtained with a little umber and the mixture is still too bright it may be taken that the proper colours have not been employed and the mixture should be changed.

The very large range of colours prepared for the use of artists and decorators might lead one to suppose that mixtures of them would not often be required. Of course, as a matter of fact, an artist's palette is usually very restricted and consists of only a dozen or so colours from which he obtains all the tints, hues and shades he requires. Occasionally he may use a little of some additional expensive colour when a special effect is desired.

The same thing is true in regard to the house painter and decorator, with the difference that the cost of colours is much more important to him than it is to the artist, because he uses comparatively such large quantities. Still, when pure tints are required, either rich or subdued, to give a finish to, or produce an unusual effect in, a piece of decoration, it will frequently be found cheapest in the end to procure a tube of some expensive colour than it would be to endeavour to imitate it by an admixture of pigments of an inferior quality.

CHAPTER V.

Colour Nomenclature.

What has been Accomplished

Since the first edition of "Paint and Colour Mixing" was published, considerable progress has been made in naming colours and settling a standard for colours by the publication of three important books. Although all of these are intended broadly for colours for every use, yet they may be said to be specialised in reference to their application. For example, the first is "Color Standards and Color Nomenclature," by Robert Ridgway, M.Sc., Curator of the Division of Birds, United States National Museum, Washington, D.C. This book, of which a full description appears below, was produced primarily for standardising the names of colours of birds, animals, insects and objects of natural history generally, but, as already stated, there is no reason why the standard should not be adopted for all colour purposes.

The second book is "Repertoire de Couleurs, par la Société Francaise des Chrysanthesmistes," published in Paris. This book consists of two portfolios, comprising 365 plates with explanatory text in French. In this case the colours were selected particularly in connection with the colours of fruit, flowers and foliage, but here again a general application would be quite practicable.

The third book to which attention may be drawn is the "Standard Colour Card of America," issued by the Textile Colour Card Association of the United States of America Incorporated, of New York. The purpose of this colour card was to standardize textile and allied

industries so that the standard name or standard number will always signify the colour so designated on the card. The latest work done in naming colours has been accomplished by a panel of the British Engineering Standards Association, as described at the end of this chapter.

Mr. Robert Ridgway's System.

It should be stated that this book includes fifty-three coloured plates and eleven hundred and fifteen named colours. The arrangement of these colours is the solar spectrum, with its six fundamental colours and intermediate hues, augmented by the series of hues connecting violet with red, which the spectrum fails to show. Mr. Ridgway gives the following explanation. If, with the red-violets and violet-reds thus added to the spectrum hues, the band forming this scale be joined end to end, a circle is formed in which there is continuously a gradual change of hue, step by step, from red through orange-red and red-orange to orange; orange through yellow-orange and orange-yellow to yellow; yellow through green-yellow and yellow green to green; green through blue green and green-blue to blue; blue through violet-blue and blue-violet to violet; and violet through red-violet and violet-red to red—the starting point—with intermediate connecting hues. In the solar spectrum, both prismatic and grating, but especially the former, the spaces between the adjoining distinct colours are very unequal; therefore, for the present purpose an ideal scale must be constructed, so that an approximately equal number of equally distinct connecting hues shall be shown.

Distinctions of hue appreciable to the normal eye are so very numerous that the criterion of convenience or practicability must determine the number of segments into which the ideal chromatic scale or circle may be divided in order to best serve the purpose in view. Careful experiment seems to have demonstrated that

thirty-six is the practicable limit, and accordingly that number has been adopted.

If the number of intermediate hues were equal in all cases, there would in this scheme be five between each two adjacent fundamental colours of the spectrum, but a greater number of recognizably distinct hues is bviously necessary in some cases than in others; for example, spectrum orange is decidedly nearer in hue to red than yellow, and, therefore, the number of intermediates required on each side of the orange is different, being in the proportion of four for the red-orange series to five for the orange-yellow, and similarly six are required for the violet-red series, while four suffice for the blue-violet hues.

There is no known means by which we can measure the proportion of two or more pigments in any given mixture, "because colour-effect cannot be measured by the pint of mixed paint or the ounce of dry pigment," but, fortunately, we have a very exact method in the colour-wheel and Maxwell discs, by which the relative proportions of two or more colours in any mixture may be precisely measured. This method has been used in the painting of every one of the 1,115 colours of Mr. Ridgway's book, by means of one disc to represent each one of the thirty-six colours (both pure and "broken"), together with a black, a white, and a neutral gray disc, the last being a match in colour to the ray, resulting from the mixture of red, green, and violet on the colour-wheel; the neutral gray disc, however, being used only for the making of discs for the broken series of colours and for the scale of neutral grays. These coloured discs are slit in one side from centre to circumference, and, therefore, interlocking two or more they may be adjusted so that either occupies any desired percentage of the whole area, which may be very precisely determined by a scale of 100 segments shown on outer edge of a larger disc, on which the coloured discs superimposed.

When connected with the colour-wheel and adjusted as may be desired and then rapidly revolved, the two or more distinct colours resolve themselves into a single uniform composite colour, whose elements are shown in their relative proportion by the scale surrounding the discs. It should here be explained that the first 12 of the 53 plates in Mr. Ridgway's book show the pure full spectrum colours with four different tints of the same colours above them produced by adding 9.5, 22.5 and 45 per cent. respectively of white, while below the pure colours are four specimens of shades obtained by adding 45, 70.5, and 87.5 per cent. of black. The remaining plates show these same thirty-six colours or hues in exactly the same order and similarly modified (vertically) by precisely the same progressive increments of white (upward) and black (downward), but all the colours are dulled by admixture of neutral gray; the first series containing 32 per cent. of neutral gray, the second 58 per cent., the third 77 per cent. and the fourth 90 per cent. The last three plates show the six spectrum colours (also purple, the intermediate between violet and red) still further dulled by admixture of 95.5 per cent. of neutral gray, these being in reality coloured grays; to which are added a scale of neutral gray and one of carbon gray, the former being the gray resulting from mixture of the three primary colours (red 32, green 42, violet 26 per cent.; which in relative darkness equals black 79.5, white 20.5 per cent.); the latter being the gray produced by mixture of lamp black and Chinese white, and the scale a reproduction of that in Mr. Ridgway's first "Nomenclature of Colours." It should be emphasized that in all cases except the scale of carbon grays, only the discs representing the middle horizontal series of colours (both pure and broken) have been used, in combination with a black and a white disc, respectively, to make the colours of the vertical scales of tints and shades.

The Choice of Names for Colours.

Mr. Ridgway gives the following useful remarks on this subject :—

While it is true that the naming of colours as usually employed has so little to do with the purely technical aspects of chromatology or colour-physics, that, as Von Bezolds remarks, "we are in reality dealing with the peculiarities of language," it is equally true that a collection of colour standards designed expressly for the purpose of identifying and designating particular colours, can best attain this object by the use of a carefully selected nomenclature. In other words, the prime necessity is to standardize both colours and colour names by the elimination of the element of "personal equation" in the matter. In no other way can agreement be reached as to the distinction between "violet" and "purple," two colour names quite generally used interchangeable or synonymously, but in reality belonging to quite distinct hues, or that any other colour name can be definitely fixed. Various methods of handling the matter of colour in zoological and botanical descriptions, etc., by the avoidance of colour names and substitutions therefor of symbols, numerals, or mechanical contrivances (as colour wheel and spectrum analyses, colour-spheres, etc.), have been devised, but all have been found impracticable or unsatisfactory. The author has taken the trouble to get an expression of opinion in this matter from many naturalists and others, and the preference for colour-names very greatly predominates ; consequently, whenever it has been possible to find a name which seems suitable for any colour in this work, it has been done, leaving as few as possible unnamed, and for these some other means must be devised for their designation.

The selection of appropriate names for the colours depicted on the plates has been in cases a matter of considerable difficulty. With regard to certain ones, it may appear that the names adopted are not entirely

satisfactory: but to forstall such criticism, it may be explained that the purpose of these plates is not to show the colour of the particular objects or substances which the names suggest, but to provide appropriate, or, at least, approximately appropriate, names for the colours which it has seemed desirable to represent. In other words, certain colours are selected for illustration, for which names must be provided; and when names that are exclusively pertinent or otherwise entirely satisfactory are not at hand, they must be looked up or invented. It should also be borne in mind that almost any object or substance varies more or less in colour; and that, therefore, if the "orange," "lemon," "chestnut," or "lilac" of the plates does not exactly match in colour the particular orange, lemon, chestnut or lilac which one may compare it with, it may (in fact does) correspond with other specimens. Without standardization, even if arbitrary, colour nomenclature must, necessarily, remain in its present condition of absolute chaos.

Even the standard pigments are not constant in colour, practically every one of them being subject to more or less variation in hue, or tone, different samples from the same manufacturer sometimes varying to the extent of several tones or hues of the present work; indeed, in every case where two or more samples of the same colour have been compared, it has been found that no two are exactly alike, the difference often being very great. For example, of five samples of "Vandyke brown," only two are approximately similar, each of the other three being widely different, not only from one another, but from the other two, one being a blackish brown, another reddish brown, the third a yellowish orange-brown. Of eleven samples of "olive," no two are closely similar, the colour ranging from a shade of dull (grayish) blue-green to orange-brown, dark brownish gray, and light yellowish olive; and the same, or nearly the same, degree of variation is seen in absolutely every

colour examined, showing very clearly the utter worthlessness of colour name unless fixed or standardized.

In order to obtain as many colour names as possible for standardization, it has been necessary to draw from all available sources. Several thousand samples of named colours have, therefore, been collected, and for convenience of reference and comparison, gummed to card catalogue cards, with the name, source and other data thereon. These include the colours from many standard works.

"For obvious reasons," Mr. Ridgway says, "it has been necessary to ignore many trade names, through which the popular nomenclature of colours has become involved in really chaotic confusion rendered more confounded by the continual change of new names, many of them synonymous and many of them vague and variable in their application. Most of them are invented, apparently without care or judgment, by the dyer or manufacturer of fabrics, and are as capricious in their meaning as in their origin. For example, such fanciful names as 'Zulu,' 'serpent green,' 'baby-blue,' 'new old rose,' 'London smoke,' etc., and such nonsensical names as 'ashes of roses,' and 'elephant's breath.' An inspection of the sample books of manufacturers of fancy goods, such as embroidery silks and crewels, ribbons, velvets, and other dress and upholstery goods, is sufficient not only to illustrate the above observations, but to show also the absolute want of system or classification and the general unavailability of these trade names for adoption in a practical colour nomenclature. This is very unfortunate, since many of these trade names have the merit of brevity and euphony, and lack only the quality of stability.

"In any systematically arranged scheme, unless the number of colours shown is practically unlimited, it will, necessarily, be impossible to find represented thereon a certain proportion of colours comprised among even a very limited number selected at random, or only roughly

classified. Hence many (thirty-six, or more than five per cent.) of the colours shown in the old "Nomenclature of Colours," fall into the blank intervals of the present work, being intermediate either in hue or tone, or chrome, sometimes all.

"The question of giving representations of metallic colours in this work was at one time considered; but the idea was abandoned for the reason that these are in reality only ordinary colours reflected from a metallic or burnished surface, or appearing as if so reflected. The actual hue is precisely the same, though often changeable according to angle of impact of the light rays, and relative position of the eye, this changeableness being sometimes due to interference. Colours, again, vary without actual difference of hue, in regard to quality of texture or surface; that is to say, the colour may be quite lustreless, appearing on a dull, sometimes velvety, surface, while, again, it may be more or less glossy, even to the degree of appearing as if varnished. To deal with these variations, however, requires simply the use of suitable adjectives. For example, to indicate a colour which has no lustre or brightness, the adjective matt (or mat) may be used, in preference to dull, which implies reduction in purity or chroma; other adjectives appropriate in special cases being velvety, glossy, burnished metallic, matt-metallic, etc."

The French Chrysanthemum Society's Book.

This splendid work consists of 365 separate plates, arranged on the plan mentioned below with tints of each colour.

The work of compiling it was carried out under the auspices of the French Chrysanthemum Society, by M. H. Dauthenay, with a number of old collaborators who attempted a repertory to aid in the determination of the colours of flowers, foliage and fruit.

Apart from the method of Chevreul—which is based on the solar spectrum—he acknowledges that there is

no good plan of nomenclature. Since the discovery of the coal tar colours, there has been a complete revolution in the colour industry. The nomenclature employed by the colour makers, however, usually conveys no exact meaning except to specialists. Moreover, synonyms abound and the names of the dyestuffs are still further complicated by the fact that they include words which have nothing to do with colour, for instance, patent blue, cloth red, chrome violet, Perkin's mauve. At the same time, whenever the name of a colour derived from its origin seems to strike the imagination, Dauthenay has adopted it.

The ink makers use a number of names derived from the dyes that are used in making the inks. Hofman violet, methylene blue for instance. Others refer to the quality as light yellow, fast red, etc., or to the effect they will produce, brilliant lake, steel blue, etc. Some are merely commercial names, Washington yellow, Senegal red, but there are others which give an idea of the colour they represent, tobacco brown, for instance.

The painting industry, ranging from artists to the house painters, give the greatest number of names of colours derived from their origin, and the majority of these are familiar to the public. Dauthenay adopts such of these as have become classic, so to speak.

As regards the colours used in describing silks and satins, he rejects them as inapplicable or too fantastic. It is another matter with the humbler textiles; many of the colours given to woollens and cottons are familiar household words and strike the imagination, Nankin yellow, Cardinal red, Navy blue, for instance.

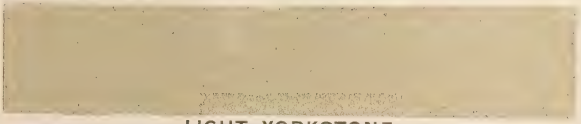
Taking all usable expressions from these industries, Dauthenay was still at a loss for names for colours. In the case of each shade still without a denomination, he therefore chose the best known flower, and the least variable one, or the commonest foliage or fruit to use in his nomenclature. In the industries mentioned, there are many colour names derived from the vegetable

"PETRUMITE"

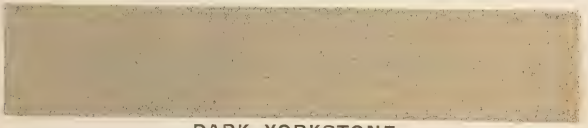
IMITATION STONE PAINT.

LIGHT BATHSTONE.

DARK BATHSTONE.



LIGHT YORKSTONE.



DARK YORKSTONE.

PORTLAND STONE.

TERRA COTTA.

NAYLOR BROTHERS (LONDON) LIMITED,
SLOUGH, BUCKS.

kingdom ; lemon, lilac, mauve, heliotrope, moss green, etc. Some colour names from the same source have long since passed into the familiar tongue, orange, rose, chestnut, violet, etc.

There are few of these words among the blues, because as a matter of fact very few flowers are really blue ; they turn more or less towards violet. Most of the blues are of mineral origin and their names are derived from this. On the other hand there are plenty of vegetable names among the greens. The green hues of foliage are of very complex tints and shades. To aid in naming them Dauthenay chose a certain number of the best known plants and used them as types of green to apply to the foliage of other vegetables. For instance, ivy, holly, eucalyptus and spinach greens.

To sum up Dauthenay's system is to denominate colours by means of the most usual terms in the ordinary language, and those most capable of striking the imagination, justifying their use by a few words as to their origin, etymology or signification.

Dauthenay's Method of Classification.

Basing his method on that of Chevreul, Dauthenay takes as basis of classification the degrees of clearness of the colours, taking count of Chevreul's observation, "yellow is the most similar colour to white in its clearness and lack of intensity, as blue is the most analogous colour to black ; red, the most of intense colours is placed between yellow and blue."

He therefore commences with pure white, following with tinted whites, or at least lowerings of other colours towards white of which the clearness is greater than the first yellow. From yellow he passes through orange to red, following the order of the solar spectrum. Then from red to blue by way of violet, in this way effecting the conjunction of the two extremities of the solar spectrum. He leaves aside green yellow, the clearness of which is comparable with that of the light reds. On

the other hand, he introduces between the reds and the violets a clearer series, that of the pinks.

As a fact, pink is simply a lowered red. The carmines are the link between the reds and the pinks, the violet pinks connect up the purples which thus form the transition between the reds and the violets. Passing from violet to blue there are many transition hues, as almost all the flowers which it is the custom to call blue are more or less violet. From blue to green the transition is naturally by way of blue green. The series is terminated with green yellow.

The cycle of free colours (unshaded with black) is thus terminated. As for the shades, that is old rose, olives, browns, ochres and chestnuts they are in two parts ; 1, the slightly shaded colours, in which the free colour is so much in excess that they can be included in the preceding series without offending the eye ; 2, the shades, which could not be included in the preceding series without offending the eye.

The first category are put among the free colours in the places where their presence seems most natural. Thus lemon yellow, canary yellow, and madder red seem much more in their place among the yellows, oranges and reds than among darker shades. The old reds and old pinks naturally follow the reds and pinks, because it is easy to make transitions between the old reds and the carmines which follow them, and also between the old pinks and the lilac pinks.

As for the deep shades they are in two special sections, making a natural transition between green yellow and pure black. The first commences with the olives and passes through the ochres to the bistre browns ; the second leaves the ochres, passes by the fawns, then by the chestnuts to touch on impure blacks and these lead to pure black, the lowered tints of which give the pure greys. In this last series the greys are lowered until the tint approaches pure white. They are in a way whites shaded with grey.

These last terminate the repertory in such a way that plate 365 can be put side by side with plate 1.

The Repertory thus contains 12 series.

I. Pure tinted whites.
II. Yellows and golds.
III. Oranges and salmons.
IV. Reds, old reds and carmines.
V. Pinks, old pinks and lilacs.
VI. Purples, garnets, and amaranths.
VII. Lilacs, mauves and violets.
VIII. Blues.
IX. Greens.
X. Bistres (Bronzes) and ochres.
XI. Fawns and chestnuts.
XII. Blacks and greys.

The plates can therefore be arranged in circle.

The first condition in determining colour is that the observer must not be afflicted with Daltonism or chromo topsy. Colour confusion and colour blindness are commoner defects than is ordinarily imagined; about 5 per cent. of the candidates for railway employment are rejected for these causes.

The second condition is that the colour must not be influenced by neighbouring colours. When a colour is placed side by side with another, it assumes a different hue or tint to the eye. When a green is placed alongside a blue, the green appears yellower and the blue more violet than they really are. If a turquoise blue is put between a cobalt blue and a navy blue, and also between an apricot tint and a green yellow, the apparent difference is very striking to the eye. The turquoise blue is greener in the former case and bluer in the latter than it is in reality. A lilac placed between a flesh tint and a pink seems to be more intense than the same colour placed between a dark green and a violet. Black and white rectangles, when side by side, are more intense than when they are isolated on the grey ground.

The third condition is to arrange the colours so that their reflects are not seen or seen as little as possible. Certain things, says Chevreul, such as dyed woollens and porcelain coloured in the furnace, do not reflect the sunlight. It is otherwise with flowers, and they must be examined in diffused light, and in a position where the direct rays of the sun do not strike the eye.

Chevreul's plan of ascertaining the colour of a flower applies equally to any other object. "If a flower," he says, "is supposed to be violet because when it is placed by the side of this colour there is no contrast, it should be compared with the hue that immediately precedes violet (5 blue violet), and with that which follows it (1 violet). It should appear redder than 5 blue violet and bluer than 1 violet."

The repertory is to be used in the same way. The nearest approach to the colour under examination must first be sought, and this being found, it must be contrasted with the neighbouring hues. This should be done in the diffused light, not only for the reasons already stated, but also to preserve the colours of the plates.

The Standard Colour Card Relating to Textile and Allied Industries of the U.S.A.

This extremely useful attempt to standardize colours for the textile trades consists of folding plates, comprising in all 106 specimens of coloured ribbons, each one of which is numbered and named. The system of standard numbers has been established, giving each colour a number consisting of four figures, which express as nearly as can be done the character of the colour according to the following scheme. The first, second and third figures indicate the relative proportions of the component parts of a colour which are as follows :—

1. White.
2. Red.
3. Orange.
4. Yellow.
5. Green.
6. Blue.

7. Violet.
8. Grey.
9. Black.
10. No change.

As the actual strength of a colour may, of course, vary, the 4th figures indicate such strength as follows :—

1. Lightest.
2. Second lightest.
3. Light.
4. Medium light.
5. Medium.
6. Medium dark.
7. Dark.
8. Second darkest.
9. Darkest.

To illustrate by two or three examples :—Amethyst is numbered S7185, the "S" (for standard) being prefixed to the number in order to avoid possible interference with the established number. On reference to the above table, it will be seen that 7 indicates violet as the principal colour, 1 the addition of white as the principal blend, 8, grey as a secondary blend which gives the colour, while the 5 indicates that the strength of the colour is medium.

The reference number for plum is S7187, which it will be observed is exactly the same as Amethyst, but that the 7 indicates that the strength of the colour is dark. To take another example, strawberry is numbered S2185, 2 being red, 1 white, 8 grey, while 5 shows that the tint is a medium one. The colour of old rose S2183, is identical, excepting that the 3 shows that it is a light tint.

In some cases where the primary or spectrum colours are used without admixture, we have no change, for instance, emerald is S5005. Emerald green, of course, is as near a spectrum colour as one can get, and 5 shows that the particular green is indicated, while the 2 ciphers following indicate that there is no change, the final 5 shows that the strength of the colour is medium.

This plan appears to be a very practical one, which has distinct possibilities, and doubtless something of the kind will be issued before long in connection with decorators' and artists' colours. It may be added that copies of the card may be obtained from the Textile Colour Card Association of U.S.A. Incorporated, 354, Fourth Avenue, New York, price $1.50, including postage.

THE BRITISH ENGINEERING STANDARDS ASSOCIATION.

During the years 1925 and 1926 this Association appointed a Committee to draw up a series of Standard Specifications for paint ingredients.

The following Government Departments and Scientific and Industrial Organisations were represented upon the Committees entrusted with the preparation of these Specifications :—

Admiralty ; Air Ministry ; Crown Agents for the Colonies ; Department of Scientific and Industrial Research ; Department of the Government Chemist ; General Post Office ; High Commissioner for the Union of South Africa ; H.M. Office of Works ; Home Office ; India Office : National Physical Laboratory ; War Office ; Bridge and Constructional Ironwork Association ; British Electrical and Allied Manufacturers' Association ; Incorporated Institute of British Decorators ; Institute of British Carriage and Automobile Manufacturers ; Institution of Civil Engineers ; Institution of Mechanical Engineers ; Institution of Naval Architects ; National Federation of Associated Paint, Colour and Varnish Manufacturers ; National Federation of Building Trades Employers ; National Federation of House Builders ; National Federation of Master Painters and Decorators of England and Wales ; North East Coast Institution of Engineers and Shipbuilders ; Oil and Colour Chemists' Association ; Railway Companies of Great Britain ; Royal Institute of British Architects.

This large Committee was divided up into three panels, one dealing with varnishes, one with dry pigments and one with ready-mixed paints. A number of sub-panels were also appointed, including one to select names for various colours. This was done by obtaining the colour cards of all the principal paint manufacturers and mounting together in groups all colours sold under the same name. These varied in a most remarkable

manner and demonstrated the necessity for some sort of a uniform colour nomenclature.

The panel selected from each group a colour which came in their judgment nearest to the name, and then larger sheets were prepared from which a final selection was made. The results are given in part in Plates XIV. and XV.

CHAPTER VI.

MIXING AND MATCHING COLOURS.

Measuring Small Quantities.—To the student who is just commencing experiments in colour mixing, the question of working accurately in minute quantities is one of great importance to avoid waste and unnecessary expenditure.

Probably the easiest way for him will be to measure his quantities rather than weigh them, and the first step towards this is to reduce all colours to a uniform liquid condition. He can then make a preliminary trial by taking a number of drops of each until the correct result is obtained. From that he can progress to a more ambitious method of measuring, by the use of a measuring glass, which need not be a costly affair, but is easily made at home from any kind of glass tube or jar, the gradations being first marked out on a strip of paper and pasted to the outside of the glass (see sketch). Another simple way of measuring liquids is to mark a piece of wood in sections, preferably of 100 in order to deal with percentages. This measure will stand in any kind of vessel used for mixing in, and is particularly useful for measuring thinners in various proportions.

Colour Mixing.

The Theory of Colour.—In theory, all colours may be made by mixing certain proportions of red, blue and yellow, and these are termed the *Primary* colours, because they themselves cannot be made from any mixture of other colours.

In practice, the colourman will not find it so con-

venient to confine himself to three colours only, for nature, and the paint chemist, has provided him with a choice range of combination colours, which will save him a great deal of trouble. In addition to this, it would be unwise to suppose that any shade of colour may be obtained from any one kind of red, any one blue, or any one yellow. There is as much variety in the primary colours as there is in the effects to be obtained from them.

No Pure Colours.—There are no absolutely pure colours at any rate in the form of paint pigments, though this may not be true when speaking of light. Red pigments incline towards blue, and are termed crimson red, or they incline towards yellow and are termed scarlet reds.

Blue pigments incline towards red and are termed violet blue, or they incline towards yellow and are termed greenish blue.

Yellow pigments incline towards red and are termed orange yellow, or they incline towards blue and are termed greenish yellow.

Peculiarities of the Primary Colours.—The first thing for the student to do is to acquaint himself thoroughly with the peculiarities of the primary colours and the principal stainers, to recognise them by their hue, in order to know how to choose them for specific purposes.

To obtain a pure green by mixing a blue and yellow, for instance, the blue must incline towards yellow, and the yellow must incline towards green. Should either of these colours incline in the opposite direction, the effect would be similar to adding grey to the colour, and the brilliance would be lost. Similarly, in choosing the colours for making a rich purple, the red must be one inclining toward blue, and the blue have a reddish hue.

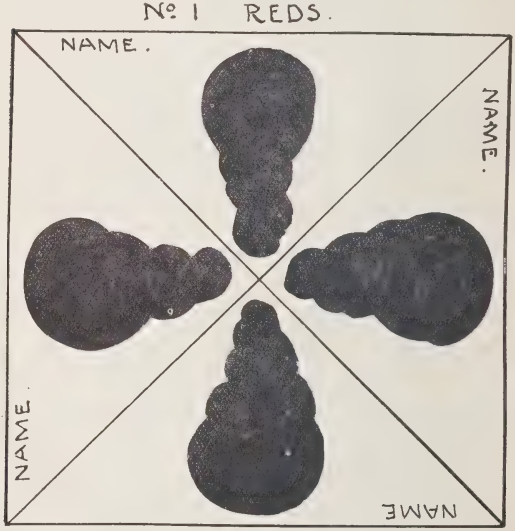
Again, a pure orange colour could only be made from a red inclining to yellow, and a yellow with a reddish hue.

Some method must be adopted of working systematically and keeping a proper record of all the various mixings, so that these can be referred to at any time.

Probably the most simple and inexpensive way is to

use a number of pieces of white cardboard, cut to a standard size, and lined out in sections, as per the sketches shown. These cards should be "sized" with gelatine, or white of egg, to stop suction.

The first set will be used for primary colours and pure stainers only, and each colour will have a separate card,



RECORD CARD - FIRST SERIES.

COMPARING PRIMARY PIGMENTS.

Nº 2 BLUES Fig. 19. Nº3 YELLOWS.

so that the various stainers which come under the same name may be compared.

The colours must be applied to the card in such a way that any difference in hue or cast may be seen and com-

pared. This is best done by following the method adopted by some manufacturers of artists' water colours. A little of the colour is taken on the middle finger, and applied fairly thick in the form of a disk, and then gradually worked downwards with a circular motion, until the colour on the lower portion of the disk is worked out almost to nothing. The white background showing through this will at once emphasise the variation in hue.

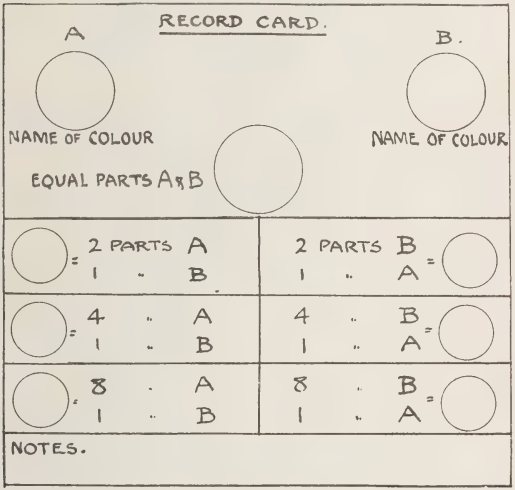


FIG. 20.

Having made a record of all the known stainers under the title of red, blue and yellow, and carefully named each one for reference, further experiments should be made of adding to each, first various proportions of white, and then various proportions of black, and recording the

result on the second series of cards, with the proportions carefully noted.

This experiment must be extended to all the stainers which come to hand ready for use, commencing with the three principal ones used by the house painters, the ochres, umbers and siennas.

Secondary Colours.—We now come to the actual mixing of two primary colours in order to produce a third, these being known as secondary colours.

Red and yellow produce orange.
Yellow and blue produce green.
Blue and red ,, purple.

According to the hue of the primaries used, so will the result be seen in the hue of the secondary colour produced.

The student will obtain much useful information from these experiments. For instance, he will find that by combining certain primary colours, he will produce a third which has always been familiar to him under some trade name, but of its composition he was quite ignorant until he produced it in this way.

An excellent example of this is the making of the well-known Brunswick Greens by mixing pale lemon Chrome and Prussian Blue in varying proportions.

The secondary colours may be intermixed in the same way to produce a third series of colours. These are more complex, containing some portion of the three primary colours in each.

Orange and green produce citrine.
Green ,, purple ,, olive.
Purple ,, orange ,, russet.

These mixings are perhaps more instructive than useful, as the resulting colours can be obtained by a much shorter process and a more simple mixture, the addition of black or grey to the primary and secondary colours giving us all the colours of the third series.

If a record of these colours be made in the manner suggested, together with a series of tints formed by the addition of varying proportions of white, and a series of shades formed by adding varying proportions of black or grey, they will form a useful and reliable guide towards determining the composition and proportion of any colour sample.

Mixing and Matching Colours.

The actual process of matching a colour, apart from any consideration of the various stainers which enter into its composition, varies to some extent, according to the form in which the sample appears.

To match a *liquid* sample is far more simple than matching a dry painted pattern, for reasons which shall be explained later.

To match a gloss paint to a flat sample or pattern, or vice versa, is always more difficult than matching flat to flat and gloss to gloss.

To match a colour which is in close proximity to other colours, and forms part of a colour scheme, such, for instance, as a single colour chosen from an elaborate wallpaper design, is really far more difficult than matching a similar colour which stood alone, and which was not influenced by other colours.

The matching of silk or other fabrics, which present a variety of shades, is always a difficult task, excepting to those of long experience, or who have adopted some definite lines upon which to work. There are many little aids to success which may, with every advantage, be adopted by the would-be colourist, and we shall try and indicate some of the best of these. At the same time, we strongly urge the student to try not only the ways indicated, but any others which may be presented to him, and to adopt that which helps him best to attain the desired end.

Before commencing these, we would like to throw out a suggestion, which will probably save him a great amount

of wasted material—Do not start to make a colour with the full amount of material which you have calculated the job will require. If you do, you will probably find that by the time you have added your stainers, you have a great deal more paint than you require. Commence by taking one-half the estimated amount, whether it be white-lead, zinc-white or one of the colour pigments, and proceed to add your stainers as directed, keeping an eye on the quantities used of each, until you arrive at the correct colour. If you happen to add too much stainer you can lighten up with a portion of the reserve pigment. Having arrived at the correct shade with the first portion, it is fairly easy to deal with the second half, seeing that you now know which stainers to use, and the approximate amount of each. It sometimes happens that a great deal more stainers have to be added than at first thought necessary, to produce the correct shade, either from bad judgment of the sample, or because the stainers employed are of low staining value, and the first mixing is found to produce enough paint, without touching the reserve portion.

In order to ensure that subsequent mixings shall be exactly the same as the first, we would direct attention to the method given under the heading of "adding stainers."

We will now take the various forms of matching, which the colourman is likely to have to deal with in the ordinary routine of the painter's business.

Matching a Liquid.—The liquid sample should be well stirred and shaken up to ensure freedom from sediment and perfect mixture.

A small quantity should be applied to the centre of a painted pattern board. Just a circle of the colour applied with the finger will do, and the pattern board should be painted white for preference. This will first give you an idea of the composition of the colour, and whether it has been made up in turps, oil or varnish, according to the gloss it retains upon drying. Proceed

to match it according to instructions given on another page, and as you proceed you put a touch of the colour you have made, next to the pattern on the board, in order to see that you are working in the right direction.

When you have obtained a colour approximating to the sample, you can make a comparative test to see what difference, if any, there is between them. To do this, take a small clean palette knife, and dip it first into the sample, and then part way into your mixing. Any variation in shade is at once discernible if the light is at all good. If you are matching a gloss paint to a gloss sample, or a flat paint to a flat sample, and can see no difference between them on the knife, you may rest assured that the colour is sufficiently close for all ordinary purposes.

If the job is a very particular one, it would be well to make a further test, by painting out a pattern of your colour and the sample on the same board, so that they just touch, but do not overlap. This must be left an hour or two for the colours to set before taking a final decision. It is a pretty well-known fact, though two mixings may be exactly alike in the liquid there will be a slight variation between them when dry, through one sample developing a stronger colour than the other. Part of this is due to the oxidation of the colour used, and part to insufficient grinding, the finer colour pigment showing the least change, so it is always the safer plan to paint out the samples and let them "set" before accepting.

MATCHING GLOSS TO FLAT AND VICE-VERSA.—When making up a gloss paint to match a flat sample or pattern, or vice-versa, the knife test is not sufficient at any time. It will do for a preliminary trial to see that your colour is somewhere near the sample in tone and shade, but they must be painted out on the same board and allowed to set.

The difference will be at once very noticeable. The one drying flat will have lost much of its richness, and probably appear lighter than when in the wet state.

To bring a flat paint up to the colour of a gloss pattern you must add a stainer which will impart the richness of tone which the oil or varnish gives to the gloss material. There is no rule by which this may be determined. Sometimes it means the use of a proportion of richer and deeper colour of the same series as that forming the base of the gloss colour. For instance, you may be matching a rich red of, say, deep vermilion. To obtain the richness in the flat colour you must add a proportion of scarlet lake. With the majority of blue colours, the rule is just the opposite, and instead of adding a richer blue you will find it necessary to use either yellow or green as a toning influence. To bring a gloss paint to an exact match of a flat sample it is necessary to adopt quite the opposite tactics, and modify its brilliance by toning down with white or grey, or other colour as occasion may require, in order to impart to the gloss paint that degree of softness which the flat paint possesses.

Matching in a Bad or Peculiar Light.—We are probably all aware that a good north light is the most suitable for matching colours, in order to see them at their true value, but such a light is not always to be obtained. Too strong a light is bad for some colours, especially the lighter ones, while for others, such as deep blues and invisible greens, the direct sunlight will best reveal the latest difference in shade or tone, just as it will in the black pigments.

It sometimes happens, however, that neither a good north light nor direct sunlight is available, but there is a peculiar reflected light present, which makes it very difficult to judge the colours clearly. The best way to overcome this is to apply a small patch of each colour, the sample and the one you are making, side by side and just touching each other, on a piece of thin clear glass or celluloid, and inspect them from the reverse side. Any difference in shade or tone will be at once detected.

SPECIMENS OF

Winsor & Newton's

Artists' Water Colours.

(Class I, Division I. Absolutely Permanent Colours).

Matching a Dry Pattern.—It is more difficult to match a dry pattern than a liquid sample, because of the deepening of colour which takes place during the process of drying. This deepening is more pronounced with some pigments than with others, and is particularly noticeable with certain blues and with greens which are derived from a mixture of blue and yellow. This may be due in part to the difference in weight or specific gravity of the two pigments, as well as to a habit which the blue has of "floating" in certain vehicles, particularly varnish, but there is no doubt that the principal cause is to be found in the continued development of the blue pigment through oxidation during the process of drying.

This bad habit on the part of certain colours makes the work of the colourman all the more difficult, because he has nothing but experience to guide him as to what allowance he must make for the deepening of the colour he is making in order that it shall dry down to match the pattern, and the only safe plan for him to follow is to paint out a portion and allow it to dry before taking a final decision. There is one method which may be applied with satisfactory results provided some account be kept for future guidance. The colour must first be exactly matched, then lightened up about two or three shades by the addition of the white or other pigment which forms the base of the colour. The quantity required for this varies with different colours, and should be recorded.

On applying a touch of the colour obtained to the dry pattern it will appear much too light, but as the colour sets or oxidises it gradually darkens to the correct shade.

Matching a Colour in Wallpapers.—When a single colour is chosen from a group of colours, such as in a wallpaper design, it is not always correct to produce an exact match, but the general effect according to the influence of the contrasting colours must be taken into account.

To view a colour which forms only a small part of an elaborate colour scheme is quite a different thing

from seeing it in large masses, and the more faithfully the colour was copied the worse match would it appear.

It is invariably necessary to tone the colour with some contrasting colour appearing in the wallpaper, and further to lighten it up to counteract the bulk effect.

The wallpaper from which the colour is chosen should be hung up in a good light, then the colour can be matched, and painted out on a fairly large pattern board and hung beside the paper. It will at once be apparent to what extent this overshadows the colour as it appears in the paper, and the necessary toning influence to use. As an instance we might imagine a design embracing some green leaves with a blue flower, on a light ground. If the blue flower were faithfully matched, and the colour applied to the woodwork, it would look altogether too strong and overpowering, and it would be found necessary to tone it considerably with the foliage green, and lighten it with the background cream, before harmony could be established. If a second panel is painted with the corrected colour and hung beside the wallpaper, the improvement is at once obvious.

Matching Silk and Varied Shade Material.—Silk varies in light and shade according to the position from which it is viewed in relation to light. As this peculiarity cannot be imparted to the paint, the matching of silk becomes purely a matter of imitating effect rather than colour. The lightest and the darkest shades appearing on the silk should be matched separately, and by combining these two in the proportion of two of the light to one of the dark an approximate match is obtained. This should be painted out on a panel and hung up beside the silk so that they can be viewed together, and the general effect noted. Any toning required to bring them into harmony can then be done.

It is well to note that fabrics which possess a "sheen" uch as silk has, can be more faithfully matched in a semi-gloss colour than is possible in a dead flat, and an

even more striking resemblance may be obtained from a gloss finish, which is finally "felted" down with pumice stone powder and oil. There is a silkiness obtained in this way which mere brush work does not possess, and a richness of colour far in excess of that obtained by flat finishes.

Adding Stainers.

Stainers in Liquid Form.—The quickest, cleanest and most reliable way of adding stainers to a paint mixture is to first reduce them to liquid form of paint consistency, with turpentine.

If they contain any trace of skins or lumps they should be strained through muslin, silk chiffon or copper gauze, before adding to the paint. The use of stainers in a lumpy or skinny condition is a constant source of bad colour matching and waste material, as the full strength of the stainer is not obtained until the final straining of the paint, when these lumps are broken up, and a stronger tint obtained than was desired or expected.

If the stainers are thinned and strained into lever lid tins they are ready for immediate use and there will be no waste.

Combining all Stainers first.—A method which has much to recommend it is the combining of all the necessary stainers before adding to the paint. It is, however, only possible to carry this out economically when some idea of quantities required is available, and a record should therefore be kept of all the standard mixtures, so that they can be repeated with accuracy.

The stainers having been mixed, a test is made by paletting up a small quantity with the base pigment and noting the colour.

Having once obtained the correct mixture, it is possible to make up two or more batches of paint, to the exact shade. It is only necessary to put aside some of the combined stainers in a lever lid tin, carefully marked,

and the colour can be repeated at any future date, either for re-doing the same, or for work which has to be similar. It is a much better way than putting aside the actual paint which in time becomes fatty and unfit for use. It also enables the colourman to mix just the bare quantity of paint he will require for any particular job, without troubling about a safety margin, which on the average job means so much waste.

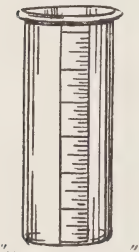


FIG. 21

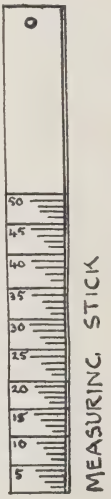


FIG. 22.

This method is particularly applicable to such stock colours as buffs, stone colours, etc. which have to be regularly repeated, and when the tins containing the mixed stainers are properly labelled and the proportions of each stainer used written plainly upon them, they form an invaluable guide for the future, not only for the colourman who recorded them, but for anyone else who for any reason has to pick up his work, or repeat his mixings.

CHAPTER VII.

REDS, AND HOW TO MIX THEM.

Having proceeded through a course of study and experiment the student will now require the actual mixtures necessary to produce the various named colours. These are given in this chapter and those immediately following.

NOTE.—*All colours marked * can be purchased ready made.*

ACACIA.—This may be described as a dark maroon. It is made by mixing five parts of black, three of Indian red, and one of Prussian blue. Less of the black will give a more pleasing shade.

*ALIZARIN CRIMSON.—A lake colour prepared from alizarin or coal tar colours. Alizarin crimson and scarlet are other varieties. They are not so brilliant as genuine madder colours, made from the madder root.

AMARANTHINE.—This is a crimson which can be made by mixing three parts of vermilionette with one of Prussian blue.

ANEMONE.—This is a reddish purple, and may be made by mixing two parts of black, one of white, six of a bright red, and six of Prussian blue.

*ANTWERP CRIMSON.—A fast red of a rich dark hue made by Messrs. Mander Brothers.

APRICOT.—Mix middle chrome yellow with a little vermilion and add a very little lake.

ARMENIAN RED.—Mix one part of yellow ochre with two parts of Venetian red.

AURORE.—A dull pink shade, which can be produced as follows: Mix together one part of Indian red, two of orange chrome, a little lemon chrome, and two of blue, lightening up with white.

BAY.—Mix together three parts of black, three of Venetian red, and a little orange chrome.

BEGONIA.—A dark red purple, which may be obtained by mixing four parts of lamp black, five of bright red, and four of Prussian blue.

BLACK MAROON.—Take four parts of black and mix them with one of a bright red and a little Prussian blue.

BLOOD RED.—Any bright red toned down with a little black will produce a shade sometimes called by this name.

BORDEAUX RED.—Take one part of black and mix with it two parts of orange chrome and one of Prussian blue. Indian red glazed with lake gives the best effect. A colour is made under this name by Messrs. Mander Brothers.

BRICK.—Use two parts of French ochre to one part of Venetian red and one part of white lead, adding more ochre if required to lighten the colour. This gives a good tint, sometimes called "brick red," and is suitable for outside work.

BRIGHT SCARLET.—Mix twenty parts of vermilion, seven parts of pale chrome, and one part of golden ochre. A good vermilionette slightly toned down with yellow answers the same purpose.

BRONZE RED.—This is a red toned down with about a fourth part of black, a little bright yellow or orange being added.

*BROWN MADDER.—A permanent lake colour made from the madder root. Nearly fast both in oil and water.

*BURNT CARMINE AND BURNT LAKE.—These are two names of the same water colour which is also called "Purple Lake." They are not permanent.

*Burnt Ochre.—Another name for light red: also called "Burnt Roman Ochre."

Cambridge Red.—Vermilion, to which is added about one twentieth part of Prussian blue, gives a colour sometimes called "Cambridge Red."

*Carmine.—This colour is usually made from cochineal if it is to be made into a water colour, in which case it is quite fugitive. Carmine, when ground in oil, is usually made from alizarin and is nearly permanent. It is very useful for glazing in order to produce a rich red.

*Carminette.—This is the registered name of an excellent colour manufactured by Messrs. Mander Brothers. It is a bright strong red, which is useful when protected with two coats of varnish. It is of no use, however, for tinting purposes, or in distemper.

Carnation Red.—Three parts of carmine lake and one part of white lead give a carnation colour, but a better result is obtained by taking pure vermilion as a base and adding carmine and zinc white until the desired rich colour is obtained. This colour is not suitable for use outside.

Carnation Rose.—White lead tinted with Indian red or vermilion, or Rubinette, made by Messrs. Goodlass, Wall and Co., Ltd., of Liverpool. A beautiful colour can be obtained by simply tinting white with Lewis Berger's permanent crimson madder.

*Chinese Vermilion.—This is the name usually given to the deepest shade of vermilion.

Cherry Red.—Mix together crimson lake, burnt sienna and azure blue, or two parts of vermilion and one part of carmine.

Claret.—Mix two parts of carmine with one of ultramarine blue. A little vermilion may be added if desired, and this may render a little yellow necessary to tone down the colour. A less rich colour may be made by mixing Venetian red and yellow ochre, and glazing with crimson or madder.

CORAL PINK.—This colour is useful only on inside work. It is made by mixing five parts of vermilion, two parts of white lead and one part of chrome yellow. Another recipe for producing shades of coral pink is one part of white, three of red, five of orange, and three of blue.

*CRIMSON LAKE.—A bright red colour made from cochineal (see Carmine). It is used both in oil and water, but is not permanent.

*CRIMSON MADDER (PERMANENT).—A beautiful and very useful colour manufactured by Messrs. Lewis Berger and Sons, Ltd., of Homerton, London, and shown on the plate facing title page of this book.

*DRAGON'S BLOOD.—A rich, deep red made from the resin of that name. The genuine colour is fugitive and an imitation for use in water only is made by mixing burnt sienna, cochineal, lake and gamboge.

DREGS OF WINE.—This shade is produced by mixing Venetian red with a little lamp black and white lead.

EGYPTIAN.—A dull yellowish crimson made by using five parts of black, one and half of white, two of orange, and one of blue, and a very little red.

*EXTRACT OF VERMILION.—Another name for Scarlet Vermilion.

*FAST MAROON.—A speciality of Messrs. Goodlass, Wall and Co. A useful colour for shop fronts, door panels, etc. Very rich in hue, and permanent.

*FAST RED.—A series of bright scarlets usually of the vermilionette type. Messrs. Goodlass, Wall and Co. make one of the best known.

*FIRE RED.—A brilliant red used instead of deep vermilion, to which it is superior.

FLESH COLOUR.—One hundred and twenty parts white lead, two parts yellow ochre, and one part Venetian red will produce an excellent flesh colour. Or mix eight parts of white lead, two parts of orange chrome yellow, and one part of light Venetian red.

An increased proportion of red may be employed where desired. A mixture of orange and white in the proportion of one part of the former to three parts of the latter may also be used, or a mixture of medium chrome yellow, ochre, and Venetian red added to white.

FRENCH RED.—Use equal parts of Indian red and vermilion, and glaze with carmine or Berger's permanent crimson madder.

GAZELLE.—To obtain this mix Venetian red, lamp black and Indian red, and add sufficient white lead to produce the desired shade.

*GERANIUM.—To produce this colour use nine parts of bright red and one of blue. Or Indian red may be used, afterwards glazing with madder lake for good work. Most of the larger colour manufacturers make geranium red which is better than one can obtain by mixing.

INDIAN PINK.—Tint white lead with a little Indian red.

*INDIAN RED.—This is a good permanent iron oxide pigment and is most useful in mixing with other colours. It is sometimes called "Mars' Red."

*ITALIAN PINK.—An artists' colour, also called "Yellow Carmine," "Yellow Madder," and "Yellow Lake." Not permanent.

*LIGHT RED.—This term might be applied to any tint of red lightened up with white. It is, however, a definite name of a water colour which is also called "Burnt Ochre," "Burnt Roman Ochre," and "Terra Rosa." It is obtained by burning yellow ochre, and is quite permanent. An excellent light red for decorator's use is made by Messrs. Mander Brothers, which may be used for all paint work, including distemper.

LIGHT PINK.—Tint white lead with a little pure vermilion. The word "pink" does not bear any very definite meaning, as almost any bright red such as carmine or crimson added to plenty of white give a good pink just as vermilion does, but of another hue.

A very pretty and useful pink is made by adding white to permanent crimson madder, as shown on the plate facing the title page of this book.

LIGHT SALMON.—Tint white lead with raw Italian sienna, burnt Italian sienna, and burnt Turkey umber. Or tint white with any bright red, toning down with sienna.

LILAC.—A great deal of difference of opinion exists as to this tint. One part of ultramarine to one part of bright carmine, added to eighty parts white lead, give a very good lilac. A cheaper way is to use Indian red and lamp black as a tinting colour, or rose pink may be added to the lead only. Yet another method for producing a lilac is to mix three parts of bright Indian red, three parts of white lead, and one part of ultramarine blue, but less white lead is preferred by some painters. A touch of yellow will help this colour if too raw for the purpose.

*MADDER LAKE.—This is principally used by artists, but it is useful to the house decorator for glazing the best work where a bright red is required.

MAGENTA.—Carmine and vermilion, with a little ultramarine blue, produce this colour.

MAHOGANY LAKE.—A pure lake of the maroon character.

*MAROON.—This colour is obtained by mixing carmine and blue black, and adding a small quantity of medium chrome yellow. It may also be made by mixing one part of ultramarine blue with three parts of Tuscan red. This gives a tint that is often considered a little too red, but this defect may easily be remedied by adding more blue. Some painters add ivory black and a little chrome yellow to carmine.

*MARKEATON RED.—This well known speciality is a very bright red which lasts as long or longer than vermilion, but is considerably cheaper. It is made by Messrs. Ellam, Jones and Co., of Derby, and is used by many of the big railway companies, Post Office, etc

*Mars' Orange.—Another name for Venetian red, which see.

*Mars' Red.—Another name for Indian red, which see.

Mexican Red.—Mix one part of red lead with four parts of Venetian red.

Mikado.—Three parts of blue and seven of red mixed with a little white, give this purplish red shade

Moorish Red.—Mix together three parts of vermilion and one part of rose pink.

Mulberry.—This is a very dark purple obtained by adding a little blue and just a tinge of red to black.

*New Persian Red.—Messrs. Mander Brothers make a bright red of good body which is sold under this name. It costs only 7d. a lb., and is fairly fast although it lasts better if protected by a coat of varnish. It must not be used for distemper.

Old Rose.—Tint white lead with French ochre, Indian red, and lamp black, or Venetian red and a very little lamp black may be used if desired.

Opaque Pink.—Tint white lead with red lead.

Opera Pink.—Tint white lead with a mixture of five parts of vermilion and one part of medium chrome green.

Oriental Red.—Mix one part of red lead with two parts of Indian red.

Orange Scarlet.—This colour may be obtained by adding two parts of orange lead to one part of white lead.

*Orange Vermilion.—The pale shade of vermilion orange lead comes nearest to this colour. The tone may be made by adding chrome to vermilion.

Peach Bloom.—This is a mixture of white lead and Venetian red. Or it may be produced by adding sufficient Indian red to white lead to give a warm tint and mixing it with equal proportions of white lead, lemon chrome yellow, ultramarine blue and light Indian red. Or a mixture of three parts of Indian

red with seventeen parts of white is sometimes used.

*Persian Red.—A bright scarlet.

Pink.—White lead tinted with orange lead gives a bright pink. See also "Light Pink."

*Pink Madder.—A lake colour made from the madder root. It is made only in water.

Plum.—Mix with equal parts of white lead, Indian red and ultramarine blue in the proportion of two parts of lead to one of each of the other colours. This makes a dark plum that is only suitable for inside work. If a light tint is desired add more white lead. A very rich plum may be obtained by mixing together ultramarine blue and carmine, and adding a little white and a little yellow.

*Pompeian Red.—Small quantities of bright red and orange are mixed with black to produce this shade, but Tuscan red tinted with red gives a better result.

Poppy.—Blue and vermilion mixed in the proportion of one of the former to twenty-four of the latter give this shade. Some colour mixers prefer to add a bright yellow instead of the blue.

Purple.—Light Indian red, four parts; white lead, three parts; ultramarine blue, two parts; or a purple may be obtained by mixing Indian red and white. A mixture preferred by some painters is made by mixing ultramarine and vermilion with a little white. A little crimson lake gives richness to the colour.

*Purple Lake.—A beautiful water colour called also "Burnt Carmine," and "Burnt Lake." It cannot be relied upon to stand light.

*Purple Oxide.—The correct name of purple brown or dark iron oxide.

Red Ochre.—This earth colour is cheap, and can be readily bought in most places. It can be imitated by mixing Indian red and chrome and adding a little vermilion.

RED TERRA COTTA.—Use equal proportions of burnt sienna and white lead. The tone may be varied by the addition of either of the umbers and the chromes. A good bright terra cotta is also made by using Venetian red as a base and colouring up with ochre and a touch of lake.

REGAL PURPLE.—Mix together four parts of white lead, two parts of cobalt blue, and one part of carmine lake.

ROAN.—Mix black with half its quantity of red and add a very small proportion of blue and white.

ROSE.—Five parts of white lead mixed with two parts of carmine give a rose colour that is suitable for inside work only. An admirable rose colour may be obtained by using zinc white instead of white lead, as the zinc is a much purer white than the lead, and hence gives a purer tint.

ROSE CARNATION.—Mix together one part of rose madder and eight parts of oxide of zinc. This is a beautiful colour, but the madder is too expensive for use except by artists. A very successful colour can be produced from Lewis Berger's Permanent Crimson Madder.

*ROSE MADDER.—A lake colour made from the madder root. It is suitable both for oil and water, but is not quite permanent.

ROSE WOOD.—To produce this colour bright red is mixed with about six times the quantity of black and a very little green. The shade given is a very dark red.

ROYAL PINK.—Mix together two parts of zinc white and carmine lake. This will only do for inside work.

*ROYAL PURPLE.—Mix one part of vegetable black, one and half of rich red, and seven of Prussian blue. Some manufacturers make this colour ready for use.

SALMON.—Six parts of white lead, one part of vermilion, and a little lemon chrome yellow. This

mixture produces a colour somewhat bright. Another salmon colour is made by a mixture of raw sienna, burnt sienna, and burnt umber. A tint preferred by some is produced by adding to the white, Venetian red, burnt umber and French ochre. Another method is to add vermilion and golden ochre to white, which gives a nice bright colour. Venetian red and chrome, added to white, gives a duller colour. Still another mixture is Venetian red, vermilion, yellow ochre and white.

*Scarlet Lake.—This colour is manufactured from a mixture of vermilion and alizarin crimson. It is suitable both for oil and water, and is permanent. A colour very similar may be obtained in one of the many vermilionettes on the market. It will be convenient to remember that all vermilions should be lightened by the use of pale chrome instead of white lead. Lead takes down the brilliancy of the colour, producing a pink.

*Scarlet Red.—This is bought ready made. It is the name given to the brightest of the oxide paints.

*Scarlet Madder.—A permanent but rather weak alizarin with which many beautiful tints can be obtained.

Shell Pink.—This colour is sometimes made by adding a little good Indian red to white, but some decorators prefer to use vermilion with a little chrome yellow and burnt sienna.

Shrimp Pink.—Mix Venetian red, burnt sienna and white lead, and add a little vermilion.

*Signal Red.—This is usually scarlet vermilion, but may be imitated by mixing orange lead, vermilionette and Paris white, or orange lead by itself may be tinted with vermilionette. "Signal Red" is a well known speciality.

Salmon Pink.—Tint white lead with equal parts of orange chrome and vermilion. If zinc white is used instead of lead the colour will be found brighter.

*Sunlight Red.—A specialty of Messrs. Mander Brothers. It is a deep crimson shade, is of good body, fast in light, and suitable for metal or wood signs, shop fronts or work exposed to the light, especially if varnished.

Terra Cotta.—Mix together two parts of white lead to one part of burnt sienna. One of the best ways to produce a good terra cotta wall is to give a good under coat of white lead, orange chrome and a little Venetian red, and when dry to apply a finished coat made from Venetian red and a little orange chrome to which has been added a little white. See also under "Red Terra Cotta."

*Terra Rosa.—Another name for Light Red, which see.

Turkish Crescent Red.—Mix equal proportions of Indian red, vermilionette and rose pink.

*Tuscan Red.—This can be bought ready made, and may be imitated by mixing ten parts of Indian red with one part English rose pink. Indian red is very similar in colour but somewhat darker. It is also cheap.

Venetian Pink.—Tint white lead with a little Venetian red.

*Venetian Red.—This colour is an iron oxide and is sometimes called "Mars' Orange." It is one of the most useful that the house painter has, being cheap, and having good covering power and body. It may be used both in oil and water, and is quite permanent. It is not very good for tinting purposes. It would not, of course, be often imitated, but Indian red—a very similar pigment—could be tinted with red. Or it may be imitated by mixing vermilion, yellow ochre, madder carmine, and a little Cappagh brown, which is an artists' colour, and is rarely used by house painters.

*Vermilion.—This bright red is a mercuric sulphide, *i.e.*, a combination with sulphur and mercury. It cannot be imitated by an admixture of ordinary

pigments, but there are many excellent substitutes on the market, most of them being vermilionettes. The pale variety of vermilion is known also as "Orange Vermilion" and "Pale Vermilion."

*Wagon Red.—Messrs. Mander Brothers make a beautiful colour under this name in two shades, "pale" and "deep." The latter is quite fast in light. Messrs. Manders' Wagon Red is not a vermilionette. It is not intended for distemper.

Wine Colour.—Add a little ivory black to a mixture of carmine and vermilion. Or use Indian red mixed with a little black or umber, and glaze with madder. See also the chapter on "Glazing."

*Yellow Lake, Yellow Madder, and Yellow Carmine, are three names given to the artists' colour which is more frequently known as "Italian Pink." It is very fugitive.

The following are a few additional colours:—

Salmon.—Zinc oxide, mixed with pale red and medium chrome yellow, gives a good salmon.

Garnet.—Dark para red, yellow ochre mixed with a little zinc oxide gives this colour.

Rose.—For this purpose, zinc oxide is sometimes tinted with red lead with a little blue and yellow lake.

SPECIMENS OF

Winsor & Newton's

Artists' Oil Colours.

(Class 1, Division 1. Absolutely Permanent Colours).

CHAPTER VIII.

BLUES, AND HOW TO MIX THEM.

NOTE.—*All the colours marked * can be bought ready made.*

*ANTWERP BLUE.—This colour may be described as a weak Prussian blue. It is also called "cyanine blue" and "Leitch blue." If necessary to imitate it, mix one part of bright green with two parts of ultramarine; add a very little zinc or other white, but not lead. Brunswick blue is frequently used in the place of Antwerp blue. It may be used both in oil and water and is nearly permanent.

*AZURE BLUE.—Also called "new blue" and sometimes used as a synonym of cobalt. To imitate mix one part of ultramarine blue and forty parts of zinc white. Another shade may be obtained by mixing forty-four parts of white, twenty-nine of green, and twenty-seven of blue. Or celestial blue and a little red on a base of white will give an azure shade. Cobalt and white may also be used.

*BERLIN BLUE.—This is only another name for Prussian blue.

BLUE GRASS TINT.—One part Prussian blue, three parts of emerald green, seven parts of white lead.

*BREMEN BLUE.—This is a colour to be bought only ready made. It is not now much used, and is not suitable for an oil colour.

*BRONZE BLUE.—A dark blue colour, which may be made by mixing three parts of black with one of Prussian blue.

*Brunswick Blue.—This is bought ready made, and can be imitated by adding white lead to Prussian blue in sufficient quantity to obtain the desired tint.

*Cærulean.—This is an artist's colour of a light and somewhat greenish blue tone. It is a stannate of cobalt. An imitation may be made from ultramarine and white, with a little yellow, although the colour is a difficult one to imitate successfully.

*Cæruleum.—A colour introduced by Messrs. Rowney and Co. It contains tin (stannic) oxide, cobalt oxide, calcium sulphate, and silicic oxide (silica). It is permanent both in oil and water colour.

Celestial Blue.—About equal parts of Prussian blue, chrome green and white lead will give this colour, but there should be most white, and the tint should be more blue than green.

*Chinese Blue.—Another name for Prussian blue, which see. Usually the term Chinese blue is applied to a high grade Prussian blue, but sometimes the reverse is the case.

*Cobalt.—This colour is alumina tinctured with oxide of cobalt. It is one of the best artists' colours, and cannot be successfully imitated. It is a beautiful and most useful colour, but unfortunately, it is expensive, and it is therefore only used in the finest work. It is quite permanent, both in oil and water.

*Cyanine Blue.—Another name for Antwerp blue, which see.

Dark Blue.—Obviously this is no very definite colour. Manufacturers often use one part of white, two of chrome green, and seven of Prussian blue. But ultramarine, or indeed any blue, may be used, and this may be first lightened with white, and black added as may be desired.

Fog Blue.—Equal parts of burnt sienna and Prussian blue, lightened up with about twenty parts of white lead.

*French Blue.—The name is applied to the best quality of artificial ultramarine, which is sometimes termed "French ultramarine. It is permanent both in oil and water.

Forget-me-Not.—This can hardly be termed a name of a colour, although it suggests a clearer idea than many of them. It can be obtained by adding white to cobalt.

Gobelin Blue.—Mix together four parts of ivory black, two of white, one of chrome green, and three of Prussian blue.

Granite (Blue).—To produce this shade mix two parts of black with six of white and one of ultramarine blue.

Heliotrope.—This colour is obtained by using two parts of zinc white, three of bright red, and four of ultramarine blue.

Implement Blue.—This is made simply by mixing ultramarine with white. Barytes and zinc mixed are frequently used for the white, as lead cannot be employed in the presence of ultramarine.

*Indigo.—This dark blue is a natural vegetable pigment, being extracted from the Indigo plant. An imitation may be produced by using nine parts of black and four of Prussian blue, but this will not look like the real thing. Indigo should not be mixed with lead or lead chromates. It is, however, a very useful colour, although not quite permanent, especially in oil.

Lavender.—Three parts of ultramarine blue and one part of carmine, added to zinc as a base, give a very good lavender tint for inside work. Ivory black mixed with a little carmine and ultramarine and added to white lead may be employed for outside work.

*Leitch Blue.—Another name for Antwerp blue, which see.

Light Blue.—This is simply an ultramarine blue tint produced by the addition of zinc; or the colour

may be obtained by tinting white lead with Prussian blue.

*Lime Blue.—This is a colour much used formerly for mixing distemper, but artificial ultramarine has to a great extent supplanted it. It must not be used in oil. The colour usually sold for lime blue is a variety of ultramarine.

Marine Blue.—A very dark blue, which is obtained by mixing one part of ultramarine blue with nine of ivory black.

Mascot.—This is a very dark blue shade, which s got by mixing black and blue in the proportion of seven parts of the former to one of the latter with a very little green.

*Mauve.—Is made from aniline, and is not permanent either in oil or water. Four parts of cobalt blue, twelve parts of oxide of zinc, and one part of carmine lake give an excellent mauve, or the colour may be obtained by mixing yellow ochre, blue black, and Venetian red with a little white lead. Another shade is obtained with blue, red and white mixed in the following proportions: blue, three parts; white, two parts; red, one part. Or white may be tinted with ivory black, carmine and ultramarine.

Methyl Blue.—Mix green with twelve times its quantity of blue and a touch of red.

Mountain Blue.—One part of ivory black, two parts of rose madder, three parts of cobalt blue, and four parts of white lead. This colour is only intended or artists' use.

Navy Blue.—Ivory or drop black mixed with one-fourth the quantity of blue will give this shade.

Neutral Blue.—A series of neutral blues may be made by tinting white lead with Prussian blue and adding burnt umber, the quantity of blue and umber being varied according to the tint required. Good neutral blues may also be made by tinting white with raw umber and a little Prussian blue. Add either a

little burnt sienna if a warm neutral blue is required, or a little black if one cool in appearance is desired.

*New Blue.—Another name for azure blue, which see.

Nile Blue.—Mix a little white with Prussian blue and chrome green, using rather less of the latter than the former. The result is a pale greenish blue.

Normandy Blue.—To get this greenish blue shade mix green and blue in about equal proportions with white.

Oriental Blue.—One part of lemon chrome yellow, two parts of Prussian blue and twenty parts of white lead.

Peacock Blue.—This colour is one upon which opinion varies considerably. A splendid colour is made by taking cobalt as a base and adding a little white and a little Chinese blue.

*Perfect Blue.—Some manufacturers produce this beautifully rich colour. It is very like cobalt, but slightly darker.

*Permanent Blue.—A pale variety of the best quality of French (artificial) ultramarine.

Pompeian Blue.—This is made by tinting white with ultramarine and adding a little vermilion and Italian ochre.

Porcelain Blue.—To get this shade mix one part of zinc white and chrome green with four parts of ultramarine blue and a touch of black.

*Prussian Blue.—This colour is certainly the most important blue the house painter has. It cannot be imitated. It works well in both water and oil, and is transparent. It is very strong and care must be exercised in using it lest too great a quantity is added to a batch of paint, which might be spoilt in consequence. It is a ferro-cyanide of iron obtained by mixing together solutions of a ferric salt and an alkaline ferro-cyanide. Prussian blue is also called

"Chinese blue." It is not quite permanent, and must not be used in distemper.

QUAKER BLUE.—Add a little black to Prussian blue, and lighten up with white.

ROBIN'S EGG BLUE.—Use white for base, tint with ultramarine until a fairly strong blue is obtained, and then tinge with a little lemon chrome green.

*ROYAL BLUE.—This is made by adding a little white to Prussian blue with a touch of crimson lake. Some manufacturers make a very rich blue, which they sell under the name of Royal blue.

SAPPHIRE BLUE.—One part of Chinese blue mixed with double the quantity of oxide of zinc. This should not be used for outside work.

SEA BLUE.—Two parts of Prussian blue, three parts of raw sienna, thirty parts white.

SKY BLUE.—This is the blue sold as "new blue." To imitate one part of Prussian blue added to one hundred and twenty parts of white lead give a sky blue, but some prefer cobalt, and this is for many purposes doubtless the best. Still another method of obtaining sky blue is to tint white lead with a little lime blue, adding a very little middle chrome, but the latter is more suitable for a distemper colour than it is for an oil paint, as lime blue is not very lasting in oil.

STEEL BLUE.—Zinc white tinted with lime blue gives this colour for distemper.

STONE BLUE.—One part of raw umber, twice the quantity of Prussian blue on a base of white lead will give this colour.

TRANSPARENT VIOLET.—Mix together four parts of ultramarine blue and one part of crimson lake. This is suitable only for artists' use.

TORQUOISE BLUE.—Two parts of cobalt blue, one part of emerald green, twelve parts of white lead.

*ULTRAMARINE (ARTIFICIAL).—This is one of the chief blues used by the painter, and must be bought ready made. It is quite permanent, both in oil and

water, and cannot be imitated, but it can be bought in many different qualities and shades, such as purple, cobalt, etc. It must not be mixed with chromes or white lead, as it contains sulphur, and there would on that account be a likelihood of discolouration. Natural ultramarine is very expensive. It is made from selected parts of the mineral *lapis lazuli*.

*Ultramarine Ash.—An expensive artists' colour made in the same way as genuine ultramarine, but of a paler shade, owing to the larger proportion of stone allowed to remain.

*Verona Blue.—This beautiful colour is manufactured by Messrs. Lewis Berger and Sons, Ltd., of Homerton, London, and is most useful for high class decoration.

Blue.—Marine blue is made by mixing ultramarine blue with a little ivory black. Care must be taken to grind the two together with a suitable medium, as there is a tendency for the black to float.

Sky Blue.—For this purpose, ultramarine blue is usually employed, mixed with zinc oxide.

CHAPTER IX.

YELLOWS, AND HOW TO MIX THEM.

NOTE.—*All the colours marked * can be bought ready made.*

ALABASTER.—This is a yellowish white in colour. Mix four parts of white with one of middle chrome yellow.

*ALIZARIN YELLOW.—A comparatively new yellow lake made from the coal tar colours.

AMBER.—An imitation of amber can be produced by mixing equal portions of burnt sienna, burnt umber, blue black and orange chrome yellow, and adding a quantity of white lead until the desired tint is obtaincd.

ANTIQUE BRONZE.—Add ivory black to orange chrome yellow in the proportion of about five parts of black and one part of orange.

ASIATIC BRONZE.—One part medium chrome yellow, two parts raw umber, and lighten with white lead.

*AUREOLIN.—An artist's water colour, often termed "cobalt yellow." It is a double nitrate of cobalt and potassium and was originally introduced by Messrs. Winsor and Newton.

*AURORA YELLOW.—A speciality of Messrs. Winsor and Newton, introduced by them in 1889. It is an opaque and brilliant variety of sulphide of cadmium of greater body than ordinary cadmiums and a much better drier. It is as bright as the best chrome, but is quite permanent.

Biscuit Colour.—The purest tints may be obtained by tinting zinc oxide with Naples yellow. Ochre added to white with a touch of umber may be used.

Brass Yellow.—This may be obtained by mixing forty parts of white lead, twelve parts of light chrome yellow, one part raw umber, and one part burnt umber. Or a mixture of French ochre and medium chrome yellow, added to a little umber, with a touch of blue, may be used to tint white as a base.

Bronze.—Take fourteen parts of black and add one part of yellow and two of green. See also under "Green."

Bronze Yellow.—Mix together five parts of medium chrome yellow, three parts of white lead, and one part of raw umber. A mixture preferred by some painters is obtained from chrome yellow, French ochre and a little burnt umber.

Buff.—Two parts of white lead and one part of yellow ochre produces a good buff, or white lead may be tinted with French ochre alone. Other shades are obtained with mixtures of two parts of black, four of white, one of red, and one and one-eighth of yellow.

Buttercup.—White lead tinted with lemon chrome gives a nice buttercup yellow.

*Cadmium Yellow.—This is an artist's colour of considerable value, but is, generally speaking, too expensive for house painters. It should not be mixed with chrome yellow, emerald green, or any pigment containing copper or lead, and tints should therefore be obtained by using zinc oxide. It is made in four shades: pale, medium, deep, and orange, and it cannot be successfully imitated. The palest shade is sometimes called "Radiant yellow." Cadmium yellow is sulphide of cadmium and is quite permanent in oil and nearly so in water.

CANARY.—This is practically another name for straw tint, and it may be mixed in the same way. The proportions for an ordinary shade of canary are three parts of lemon chrome yellow to one part of white lead, but less yellow is often preferred. Another shade is obtained by mixing two parts of white, six of yellow and two of green. Some manufacturers make an extra light chrome yellow which they call by this name.

CHAMOIS.—A dull yellow made by mixing four parts of white, five of yellow ochre and one of green.

*CHINESE ORANGE.—Another name for Alizarin orange.

CHAMOLINE.—Mix together five parts of white lead, three parts of raw sienna and one part of lemon yellow.

CITRINE.—Although this is a tertiary colour, and theoretically can be made from green and orange, opinions as to the exact shade somewhat differ. It may be made by mixing four parts of medium chrome yellow and one part of raw umber; or five parts of lemon chrome yellow and two parts of raw umber.

CITRON.—To produce this colour use Venetian red as a base and add one part of Prussian blue, two of chrome yellow and two of white.

*CITRON YELLOW.—This is strictly zinc chrome or lemon yellow, but the name is sometimes used for chrome yellow (pale), which see.

*COBALT YELLOW.—Another name for aureolin, which see.

COLONIAL YELLOW.—Medium chrome yellow mixed with white lead and a little dark orange chrome yellow gives this tint.

CREAM.—The best and purest tints of cream are obtained by tinting zinc oxide with a little Naples yellow. A good shade is obtained by mixing eight parts of white lead, two parts of French yellow ochre and a touch of Venetian red. French ochre and lead alone are often emplo ed Equal parts of raw

sienna and orange chrome used to tint white gives a nice cream. There are many other methods of obtaining this tint. *Note.*—Light buff, medium buff and dark buff may all be obtained in the same way by adding more or less of the French ochre or white.

*Chrome Yellow.—Normal chromate of lead produced by precipitation. These yellows are cheap and very useful to the house painter, but although permanent in sunlight they darken when exposed to pure air. There are five different shades known as primrose, lemon, middle, orange and scarlet chrome. The latter is sometimes called orange chrome, deep.

Daffodil.—Lemon chrome mixed with a little Venetian red will give this colour.

*Daffodil Yellow.—This name is sometimes given to the palest tint of cadmium yellow.

Deep Cream.—This colour is made by tinting white lead with yellow ochre and a little Venetian red. (See Cream.)

Ecru.—Tint white lead with French ochre and medium chrome yellow. A tint which is sometimes called stone colour is produced in the same way. Another shade of ecru may be obtained by mixing three parts of black, eight parts of white, three of medium chrome yellow, and one of Brunswick green.

*Gamboge.—This is an artist's colour. It is a gum resin, is somewhat fugitive, and is useless for the purpose of the house painter. A preparation called "Gamboge" is ground in oil, but it is an alizarin yellow.

Gold.—To obtain the colour known as "gold," white lead may be tinted with five parts of golden or yellow ochre and one part of vermilion, or a mixture of light chrome yellow, French ochre and vermilion may be used instead to tint the white lead. The quantity of yellow used should be considerably more than the ochre.

*Gold Ochre.—Another name for Roman ochre

HAY COLOUR.—French ochre, medium chrome yellow, and lamp black used as tinting colour for white lead will give a hay colour, or raw Italian sienna and lamp black may be employed if desired.

*INDIAN YELLOW.—A rich yellow made from "purree," the dung of camels, etc. It is chemically a magnesium salt, and if properly prepared by repeated washings is practically permanent. It is permanent both in oil and water.

*ITALIAN LAKE.—A colour made from quercitron bark. Also called Italian pink, yellow madder, or yellow carmine. It is not permanent.

IVORY.—Varying tints of ivory are best obtained by tinting zinc oxide with Naples yellow. The addition of a very little medium chrome yellow to white lead also produces an ivory or a very little golden ochre may be used. Another way is to tint white very slightly with middle chrome and a touch of black.

JONQUIL YELLOW.—Tint white lead with medium chrome yellow to which has been added a very little vermilion red. One of the favourite methods is to employ sixteen parts white lead, one part of indigo and two parts of light red, adding as much chrome yellow as may be desired. Another way of making jonquil yellow is by simply mixing with a little green about forty times the quantity of yellow.

*KINGS YELLOW.—This was formerly arsenious sulphide, but as that colour fades so rapidly pale chrome yellow is usually employed.

LEGHORN.—This is a pale yellow shade, which is obtained by mixing white and medium chrome yellow in about equal proportions.

LEMON.—For this colour, lemon chrome yellow is used alone, but the tint may be made by using white lead for a base and adding medium chrome yellow until the desired tint is obtained. The tint that is usually preferred is obtained by mixing five parts of

chrome to two parts of white lead, and adding a little green. However, lemon chrome yellow purchased ready made is the best. In artists' colours a lemon yellow is made which is also called "strontium yellow," and sometimes "yellow ultramarine."

LIGHT BUFF.—A little yellow ochre added to white lead gives a good buff colour, the tint varying with the quantity of ochre.

LIGHT DECK.—This colour may be produced by mixing medium and lemon chrome yellow with white.

LIGHT STONE.—Tint white lead with French ochre and lamp black.

*LEMON CHROME.—This is the palest shade of lemon chrome yellow. Some makers produce a still lighter shade which they designate "canary chrome." It is very useful for preparing the lighter shades of yellow, and may be imitated by adding cadmium yellow to zinc white.

*LEMON YELLOW.—Is also called "Barium Yellow," and is a preparation of Chromate of Barium. In the deeper shades a little chromate of strontium is often used. The pale variety is also called yellow ultramarine or permanent yellow. Care should be taken to distinguish between lemon yellow and yellow chrome. Pure lemon yellow is permanent both in oil and water.

MAIZE.—Mix yellow and white in the proportion of about three parts of the former to one of the latter to get this light yellow shade.

*MANDER'S YELLOW.—This is intended to be used as a substitute for old Oxford ochre, but is claimed to be superior. It is based on ochre and is of great strength and body.

MANILLA.—This colour is sometimes called "deep deck." It is made by tinting white lead with French ochre and chrome yellow. Or a mixture of white with four times the quantity of yellow will produce a shade of manilla.

MARIGOLD.—This is obtained by mixing a very little bright yellow with orange chrome.

*MARS YELLOW.—Another name for Roman ochre, which see. It is quite permanent, both in water and oil.

MELON.—Mix equal quantities of black and white. Add twice the bulk of orange chrome and a quantity of medium chrome equal to the mixture of black and white.

MUSHROOM.—A dull yellow shade, which may be obtained by adding one part of orange and two of yellow to eight parts of black.

MIDDLE STONE.—Mix as described under "Stone," but use more umber and ochre.

*NAPLES YELLOW.—A permanent yellow made from an admixture of oxide of zinc and cadmium yellow. In oil colours it may be imitated by mixing lead or zinc with cadmium and adding a little ochre. Naples yellow, when mixed with varying proportions of zinc oxide, yields pure tints of cream, ivory and biscuit.

NEUTRAL ORANGE.—A water colour made from a mixture of cadmium yellow and Venetian or light red.

OLD GOLD.—Use middle chrome with a little vermilion and burnt sienna, and add a very little cobalt. A cheaper colour may be made by mixing ochre and burnt sienna. One part of green and three of bright yellow mixed with a little white will give an old gold shade. Or it may be obtained in the same way as "Gold" (which see), but a little burnt umber may be added. Some painters prefer to tint white lead with a mixture of chrome, raw sienna and vermilion. White tinted with a little orange chrome and burnt umber also gives a good old gold tint.

OLIVE YELLOW.—This colour is sometimes called olive brown. It is made by mixing three parts of burnt umber with one part of lemon chrome yellow,

a larger quantity of yellow being added if a lighter shade is required. Another method is to mix ten parts of black, one of orange, twelve of yellow, and five of green.

ORANGE.—Mix white, yellow and orange in the following proportions: one part each of yellow and white and eighteen parts of orange. Or another shade is got with seventeen parts of orange, six of yellow and two of white. Orange chrome yellow can be easily purchased, however, and gives this colour without any admixture being necessary.

*ORPIMENT.—Another name for pale chrome yellow.

*OXFORD OCHRE.—Another name for yellow ochre but usually applied to a good grade.

*PERMANENT YELLOW.—Another name for lemon yellow (pale), which see.

PERSIAN ORANGE.—Mix fourteen parts of orange chrome, five parts of yellow ochre and one of white.

POMPEIAN YELLOW. — Tint white with Italian ochre and add a very little ultramarine and vermilion

PORTLAND STONE.—Mix equal parts of yellow ochre and raw umber, and lighten up with white until the desired tint is obtained.

*PRIMROSE YELLOW.—Lemon chrome used by itself answers admirably. Another variety is called "citron yellow."

PRIMROSE. — Ten parts of white, three parts of green and four parts of yellow will give this light greenish yellow. Another shade is got by mixing one part of orange, two parts of green and five parts of yellow.

*RADIANT YELLOW. — Another name for pale cadmium yellow.

*ROMAN OCHRE.—A bright coloured ochre often called "gold ochre," and sometimes "Mars yellow." It is quite permanent, both in oil and water.

SPRUCE YELLOW.—Add a little Venetian red to a mixture of French ochre and white lead.

STONE.—This colour, so much used in London, is usually made by mixing together five parts of white lead, two parts of French yellow ochre and one part of burnt umber. By adding a little raw umber, the tint may be varied as desired. This colour is suitable for outside work. Another method for obtaining the shade is to tint white with medium chrome yellow and burnt umber.

STRAW COLOUR.—Lemon chrome mixed with raw umber.

STRAW. — White lead tinted with a little chrome yellow produces an excellent straw tint, but some prefer to add a little French ochre. Or medium chrome yellow may be used as a base, and a mixture added of white, French ochre and Venetian red.

*STRONTIUM YELLOW.—A name given to the deepest shade of lemon yellow.

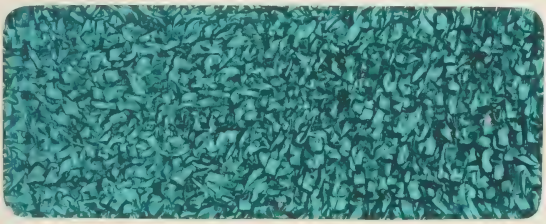
*YELLOW LAKE.—This is a very fugitive colour which has but little body, but is useful for glazing. It is also called "Italian lake," "yellow madder," and "yellow carmine." To imitate it use equal parts of burnt umber and white lead and tint with chrome yellow and lake. Or mix umber and white in equal proportions and add Naples yellow and scarlet lake. To obtain this colour in its full richness it is quite necessary to glaze either admixture with yellow lake.

*YELLOW OCHRE.—The ochres are natural mineral pigments, consisting of clay and ferric earth, which are among the cheapest and most useful at the command of house painters. They can be used in any vehicle and are quite permanent, while they do not affect any other colour with which they may be used. Oxford ochre is generally accepted to be the brightest of the series, while it is distinguished also for the depth of its covering power.

APPLE GREEN No. 5 on UNDERCOATING No. 5.

AMBER No. 6 on UNDERCOATING No. 6.

CRIMSON No. 9 on UNDERCOATING No. 9.



PEACOCK BLUE No. 12 on UNDERCOATING No. 12.

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*Yellow Ultramarine.—Another name for lemon yellow (pale), which see.

*Zinc Yellow.—This is a chromate of zinc which is quite fast in light, and possesses the advantage of permanence even in the presence of impure air, sulphuretted hydrogen, etc. It may be mixed with other colours, without adversely affecting them. It is also known as "zinc chrome" and "citron yellow."

Citron Yellow.—Primrose and chrome yellow, mixed with zinc oxide, gives an excellent citron yellow.

Cream Yellow.—The same mixture, with about double the quantity of zinc oxide, gives a cream yellow.

Biscuit Yellow is made from lithopone, orange chrome and yellow ochre, but is only suitable for inside work.

Ivory Yellow.—10 of zinc oxide and one of good yellow ochre will produce this colour.

CHAPTER X.

GREENS, AND HOW TO MIX THEM.

NOTE.—*The greens marked * in the following list may be purchased ready made.*

*ALIZARIN GREEN.—This series of greens is manufactured from the coal tar colours and may be regarded as lakes. They are practically permanent, and take the place of sap green, Hooker's green, and Prussian green.

ALOES.—A pale sage green shade. To obtain it mix six parts of black, three of white, one of chrome yellow, and three of Brunswick green.

APPLE GREEN.—The simplest way to obtain this is to mix medium chrome green with about thirty times the quantity of white lead, but other greens may be employed with the addition of a little Prussian blue when necessary. Or a little orange chrome yellow may be added to the medium chrome green and white lead. A very good shade can be produced by mixing one part of white with four of yellow and nine of green.

AUTUMN GREEN.—Mix one part of chrome yellow with seven of black and two of emerald green.

*BICE.—A water colour called also "Green Lake."

BLUE GREEN.—Equal proportions of deep chrome green and cobalt, or three parts of chrome green and one of Prussian blue, added to white lead in the proportion of about four times the quantity of lead to the mixture of green and blue, will give a tint which is sometimes called "Blue Green."

BOTTLE GREEN.—Mix together five parts of medium chrome green and one part of blue black. A similar colour may be obtained by adding Prussian blue to blue black and lemon chrome. Another shade is made by using four parts of black and one of green.

*BRONZE.—A water colour made of a mixture of chrome greens.

BRONZE GREEN.—The usual method is to mix black with chrome yellow (deep), but indigo may be used instead if desired. A much brighter colour is obtained by a mixture of medium chrome yellow, Prussian blue, and burnt sienna. Or the following recipe may be used: Middle chrome green, five parts; blue black, one part, burnt umber, one part. A light bronze colour may be obtained by adding more green or by using light instead of medium green. Other shades of bronze green may be got by adding a little lamp black to dark chrome green, or by taking medium chrome green and adding lamp black and a little raw umber.

*BRUNSWICK GREEN.—This colour is sold in three shades. It may be imitated by a mixture of Prussian blue and chrome yellow. Chrome green is really the same colour, the latter being the name used by artists' colourmen.

*COBALT GREEN.—A useful, permanent colour manufactured by tinting oxide of zinc with oxide of cobalt. It is permanent both in water and oil.

CHARTREUSE.—This is a light yellowish green colour. Mix four of chrome yellow and five of chrome green, lightening up with white.

*CHROME GREEN.—This colour is bought ready made, and is by no means permanent. It is not suitable as a water colour. To produce it by admixture, add Prussian blue to lemon chrome yellow in the proportion of about one part of blue to eight parts of yellow.

*CHROMIUM OXIDE.—This is a beautiful, rich and

permanent green of an emerald green hue. Chemically, it is a sesquioxide of chromium. It is an artist's colour.

*Cinnabar Green.—Similar in composition to chrome green, but darker, owing to a deeper variety of chrome yellow being employed. It is not used in water, and is not quite permanent in oil.

Eau de Nil.—Tint white lead with medium chrome yellow, emerald green and a touch of Prussian blue.

Egyptian Green.—Add two parts of raw umber and one part of lemon pale yellow to white lead. Give the green tone to it by means of a little Prussian blue.

Elephant Green.—A dark green, obtained by adding emerald green to black.

Electric Green.—Mix blue black and lemon chrome, add a little cobalt and lighten up with white. Another method is to use emerald tint, and to add a little blue to it. Usually, the term is a very vague one, and is applied to almost any greenish blue.

*Emerald Green.—This beautiful, bright green cannot be successfully imitated. It must not be mixed with ultramarine. The pigment is chemically an aceto-arsenite of copper, is a great favourite with some painters, while others never use it. In America, the pigment is known as "Paris green," but it is not there used to any extent by painters, although it is used as an insecticide. In the absence of the real thing, more or less presentable imitation may be obtained by mixing eight parts of white lead and one part of medium chrome green, or a light shade of chrome green may be used without lead. Emerald green, although so bright, has very little body, but it is very useful for glazing, *i.e.*, a thin finishing coat is given over a good green ground to brighten it. Very near imitations of emerald green are made by most colour houses,

and are sold under various names such as emerald tinted green, emerald tint green, etc. They are not, however, suitable for distemper. Emerald green stands better in oil than it does in water.

FOLIAGE GREEN.—One part of blue black may be mixed with four parts of lemon chrome. Use medium chrome yellow if a darker shade is required.

FRENCH GREEN.—This is a bright yellowish green, which may be obtained by adding to emerald or deep chrome green about one-tenth part chrome yellow. Yellow ochre is sometimes used instead.

GAGE GREEN.—This is a variety of sage green. It may be made in the same way as pea green, and when this is reached a little black should be added to bring it to the required sage colour.

*GENUINE GREEN.—This is usually to be had ready mixed, but it varies considerably in name as well as in the exact tint. It comes very near to what some manufacturers call "Deep Royal Green," while it is not far removed from an olive.

GRASS GREEN.—The colour sold as "extra light chrome green" makes a splendid grass green without any addition, but if it is not available, lighten up medium or dark chrome green with chrome yellow.

*GREEN BICE.—See Bice.

GREEN SLATE.—Tint white lead with a bright green toned down with ochre and lamp black.

*GREEN LAKE.—A water colour also called "Green Bice."

GREEN STONE.—Twelve parts of white lead tinted with one part medium chrome green and one part of raw umber give this tint, or the tinting colours may be French ochre and emerald green with a little lamp black.

GREY GREEN.—Use ultramarine blue, lemon chrome yellow, blue black and white lead.

*GUIGNET'S GREEN.—Another name for Viridian which see.

*Hooker's Green.—An artist's colour made in three or more beautiful shades and called also "Alizarin Green." Originally Hooker's green was made from an admixture of pigments, but its fugitive character has led to the alizarin being substituted by some firms.

*Holly Green.—A useful colour made by Messrs. Thomas Fewster and Son, Ltd., of Hull.

Invisible Green.—A dark green made by mixing nine parts of black and one of bright green.

Ivy Green.—This is produced by a mixture of French ochre, lamp black and Prussian blue.

Leaf Bud.—This colour is suitable for inside work. It is made by mixing orange chrome yellow, light chrome green and white lead in equal proportions.

Light Green.—Equal quantities of white and blue and rather more than twice the amount of green give a very good shade.

Light Olive Green.—Mix three parts of middle chrome, two parts of black, and one part of burnt sienna and lighten up with white lead until the desired colour is obtained.

*Lime Green.—This is a very fast colour which is bought ready for use, and is only suitable for distemper, etc. It cannot be used with oil.

*Malachite Green.—A prepared native carbonate of copper.

Manse Green.—This is produced from a mixture of a bright green, medium chrome yellow and French ochre.

Marine Green.—Mix one part of middle chrome green with four of black.

Medium.—A green of this name may be purchased ready made. It is very similar to middle Brunswick green.

Mignonette.—This is a dark green shade, obtained by mixing one part of chrome yellow and one of Prussian blue with three parts of chrome green and fifteen parts of black.

Muscovite.—This is a dark sage yellow greenish shade. It may be obtained by mixing six parts of Prussian blue, thirteen of chrome green, three of orange chrome, eight of white, and twenty of black.

Moss Green.—Tint white lead with French ochre, a bright green and a little lamp black.

Moss Rose.—This pale greenish shade is obtained by mixing chrome or Brunswick green, bright yellow and white in the proportions of one part green, four of yellow and three of white.

Mountain Green.—Add to medium chrome yellow sufficient cobalt to produce the desired hue, adding a little white if necessary.

Myrtle.—Three parts of dark chrome green, one part of ultramarine blue, and a little white lead will give an excellent myrtle colour.

Night Green.—Seven parts of chrome green and three parts of yellow ochre will give this shade.

Nile Green.—Five parts of white, nine of emerald green and six of Prussian blue will give this shade. This may also be mixed in the manner described in "Eau de Nil."

Olive.—Mix together ten parts of lemon chrome yellow, one part of ultramarine blue and one part of light Indian red. Another method is to use eight parts of lemon chrome yellow, one part of blue black, and one part of Prussian blue. Or the following proportions give very good shades: Three parts black, four parts white, four parts red, two parts yellow, and eleven parts green; or, fifteen parts of white, twenty of red, twelve of yellow, and fifty-three of green. Some painters add equal portions of Prussian blue and lamp black to lemon chrome yellow for a base, or the base may be ochre instead of chrome, and a little of the yellow be added.

*Olive Green.—The colour sold under this name is made from quercitron lake and ultramarine. In

water colour it consists of a combination of Indian yellow, umber and indigo.

*Olive Lake.—An artist's colour more familiarly known as "Sap green," and sometimes "Olive green."

Oriental Green.—Is made by mixing equal proportions of raw umber and lemon chrome yellow.

Peacock Green.—A mixture of seven parts of white, fifty parts of emerald green and forty-three of Prussian blue will give this shade. A little yellow is sometimes added. The colour is best produced by giving a final transparent coat over a ground colour. For the ground mix a rich green, a very deep Brunswick green and middle chrome. Over this apply a very thin coat of a deep bluish green made from Prussian blue and lemon chrome.

Pea Green.—Forty-eight parts of white lead and one part of chrome green will give this colour, or emerald green may be used if desired. Some makers mix medium chrome green and white lead in the proportion of five parts of the latter to one part of the former to obtain a pea green, but the proportions may be varied according to the exact shade required.

Persian Green.—This is only another name for emerald green, the vivid and somewhat staring hue being sometimes employed in Oriental decorations and being then termed "Persian green."

Pistache.—This is a yellowish green shade. It may be obtained by mixing seven parts of black, one of yellow ochre and one and half of chrome green. Or chrome yellow may, if desired, be substituted for the ochre.

*Privet Green.—A useful green, guaranteed not to face, made by Messrs. Goodlass, Wall and Co.

*Prussian Green.—This is sometimes an alizarin green. More often it is made of a mixture of gamboge and Prussian blue for water and quercitron lake and Prussian blue in oil. It is fairly permanent both in

water and oil. To imitate, mix five parts black, three darts chrome yellow, and twelve parts emerald or medium chrome green.

QUAKER GREEN.—Mix equal proportions of Venetian red and medium chrome yellow, and add blue black. Add to this mixture a quantity of chrome green equal in bulk to the three. This will give an excellent Quaker green.

*QUEEN ANNE GREEN.—A useful neutral green made by Messrs. Mander Brothers.

REED GREEN.—Mix white, chrome yellow and chrome green in about equal quantities to produce this shade. The name, however, has no special significance, and an admixture of almost any yellow and green, lightened up with white, might be used instead.

*ROYAL GREEN.—A rich green usually made in three or four shades.

SAGE GREEN.—This may be produced by tinting white lead with four parts of light chrome green and one part of ivory black, or the white lead may be tinted with a mixture of French ochre, lamp black, and Prussian blue. Another recipe is as follows: Add raw umber and chrome green in the proportion of about one part of the former to two parts of the latter added to white lead until the desired shade is obtained. A pale Brunswick green and a very little black used to tint white also gives a good sage green.

*SAP GREEN.—An artist's colour known also as "Olive green." The colour was formerly made by the admixture of various pigments and was by no means permanent, but now the alizarin colours are usually employed both for water and oil. Mix with white lead, medium chrome yellow, and a very little lamp black.

*SAXON GREEN.—A useful colour of lead base.

SEA FOAM.—Tint white lead with medium chrome yellow and emerald green, or if too bright, use medium chrome green instead of the emerald.

SEA GREEN.—This colour is obtained by adding deep chrome to white lead. Another sea green, and a very good one, is obtained by mixing light Brunswick green, raw sienna or ochre and white.

SEERED GREEN. — Tint white lead with French ochre, medium chrome yellow and a little bright green.

STARLING'S EGG GREEN. — A mixture of light chrome and Prussian blue, lightened up with white, will produce this colour.

*SUFFIELD GREEN.—A series of beautiful greens made in nine shades by Messrs. Mander Brothers, Wolverhampton. They are a decided improvement on Brunswick greens, standing the light much better. They are made in various useful art shades, and the author, who has used them, considers them to be worthy of the highest praise from a decorator's point of view.

TEA GREEN.—Medium royal green, chrome yellow and lamp black, added to white lead will give this colour.

TERRE VERTE. — A natural green earth found in Italy and elsewhere. A yellowish variety is sold called olive terra verte. It is quite permanent both in water and oil.

VELVET GREEN.—Mix three parts of burnt sienna five parts of light chrome green and eight parts white lead.

*VERONESE GREEN.—See Viridian.

VENETIAN GREEN.—Lighten up dark chrome green with white lead.

*VIRIDIAN.—A beautiful transparent green; also called Veronese green. It is a hydrated chromium sesquioxide and was originally introduced by Messrs. Winsor and Newton. It is useful to the decorator for glazing, and is permanent both in water and oil.

WATER GREEN.—Raw sienna mixed with a little deep chrome green and added to white lead gives a water green tint.

WILLOW GREEN.—Tint white lead with medium chrome green, and add a little burnt umber or ivory black.

*ZINC GREEN.—A bright colour intended to take the place of Brunswick green as it stands the light and impure air better.

Mix zinc green with lithopone and little umber.

CHAPTER XI.

BROWNS, AND HOW TO MIX THEM.

There is no definite line of demarcation between the browns and the darker yellows any more than there is between the blues and the greens, or the reds and the oranges. One colour may be said to merge into the other. Still, Vandyke brown may be taken as a typical brown, and should, therefore, be experimented with. Umber is another valuable brown which yields tints of a somewhat greenish hue. In comparing different browns it is well to mix not only white with them, but also Venetian red, orange, and yellow in various proportions. Then add a little black, and then ochre, and perhaps sienna.

The colour mixer who has worked conscientiously through this book thus far, will probably be surprised at finding the number of rich browns obtainable by these means.

ACORN BROWN.—This is very similar to a rich chocolate, and may be made in the same way.

ALDERNEY. — This is an orange brown in hue, and may be made by mixing fourteen parts of black, one of white, two of orange, and three of yellow.

*AMBER BROWN. — Mix together six parts of burnt umber, four parts of medium chrome, and three parts burnt sienna.

ARABIAN BROWN.—This is a dark terra-cotta, and may be made by adding white and black to Indian red.

ARGUS BROWN.—This is a very dark brown, and may be made by mixing six parts of black with two parts of orange and one part of yellow.

AUBURN TAN.—This is also called "auburn brown." Mix together one part of burnt umber, three parts of golden ochre and twenty parts of white lead or zinc oxide.

AUTUMN LEAF.—This is also called "leather lake." It may be made by mixing on a base of white lead, French ochre, orange chrome yellow and Venetian red.

BISMARK.—A shade of this name may be produced by using two parts of black, one of red and one of orange, which mixed together form an orange brown.

*BISMARK BROWN.—This colour is obtained by mixing with six parts of black, one part of orange and one of yellow.

*BISTRE.—This colour is made from soot obtained by burning wood. It is principally used by artists, and must not be mixed with oil. It is not always reliable for its permanency. It may be imitated by mixing together ten parts of black with two of red and a little green.

*BITUMEN.—A dark colour called also asphaltum. It is not ground in water and is liable to cause cracks in paint.

BRONZE BROWN.—Black coloured with a little orange chrome and bright green.

BROWN.—The methods of obtaining different browns will be found under the headings of the respective names, such as "Chestnut," etc. A good average brown may be obtained by mixing together three of Indian red, two parts of lamp black and one part of yellow ochre. A lighter colour is obtained by using more ochre and less black, in fact, a large variety of brown tints may be produced by varying the proportions of ochre and black.

*Brown Ochre.—Also called "Roman ochre," which see.

Brown Pink.—A lake made from quercitron bark. It is fugitive.

Burnt Rose.—This is a dark red brown shade. To produce it use two parts of black, one and half parts of red, two parts of orange, and one of blue.

*Burnt Sienna.—This is a sienna calcined, the effect being to produce a darker shade. It is quite permanent, both in oil and water. The colour is a most useful one, and will be found in many of the mixtures in this book.

*Burnt Umber.—This is a rich dark greenish brown, but the shade varies considerably in different qualities. It is made from natural earths by calcining, and is permanent both in oil and water. Turkey umber is the richest. Umbers should always be purchased ground ready for use.

Cafe au Lait.—To produce this shade mix five parts of black, three of white, one of yellow, and a little orange. A little red may also be added if desired.

*Caledonian Brown.—A natural earth in which the colour is due to ferric oxide. An imitation may be made by mixing Vandyke brown and sienna.

*Cappagh Brown.—This is an artist's colour of a reddish brown colour, being very like umber. It contains manganese.

*Cassell Earth.—Another name for Vandyke brown, which see.

Chestnut.—This rich brown may be obtained by mixing four parts of medium chrome yellow and two parts of Venetian red. One part of yellow ochre may be added if desired. Equal parts of chrome and vermilion with a little black may also be used.

Chocolate.—Five parts of burnt sienna and one part of carmine or lake give a rich chocolate. A less expensive colour is obtained by mixing Indian red

and lamp black with a little yellow ochre. A touch of vermilion will clear and brighten this mixture. Another way to produce chocolate is to mix black with red, but this gives a more or less muddy shade. White and burnt umber also yield a chocolate brown.

CINNAMON.—Six parts white lead, two parts burnt sienna, and one part of golden ochre make a good cinnamon ; or French ochre, English Indian red and a little lamp black will produce the same colour. Another way is to mix Italian sienna and burnt umber.

CLAY DRAB.—Mix equal parts of white lead, raw umber and raw sienna, and add a little chrome if desired. Some painters prefer to add a little medium chrome yellow.

COCOA-NUT BROWN.—This shade may be obtained by mixing one part of white lead or zinc oxide with double the quantity of burnt umber.

*CYPRUS UMBER.—Another name for raw umber.

COFFEE.—To produce this colour mix together five parts of burnt umber, two parts of yellow ochre and one part of burnt sienna.

*COLOGNE EARTH.—Another name for Vandyke brown. It is permanent in oil, but fades slightly in water.

COPPER.—Tint zinc white with French ochre, Italian sienna and lamp black to obtain the shade shown in the sample. A very good copper shade is obtained by mixing two parts of medium chrome yellow, one part of Venetian red, and one part of drop black or two parts of lamp black, three parts of medium chrome yellow and six parts of Venetian red.

CORK COLOUR.—Tint white lead with French ochre, Indian red and a little lamp black, or with raw Italian sienna and burnt umber.

*CYPRUS UMBER.—One of the best grades of umber possessing a greenish hue, which is liked by artists.

Dark Drab.—French grey, Indian red and lamp black added to white lead give this colour.

Dark Lava.—Mix French ochre, Indian red and lamp black, and lighten with white lead.

Dark Oak.—Add French ochre and Venetian red to white lead as a base.

Doe Colour.—This may be produced by mixing raw Italian sienna and burnt umber with white lead, or French ochre and mineral brown with a little lamp black.

Dove Colour.—White lead, with a little Prussian blue and a touch of ivory black will produce an excellent dove colour ; but French ochre, Indian red, and lamp black may be employed, or a mixture of raw and burnt Turkey umber and Italian sienna.

Drab.—A good drab is made by using burnt umber and white lead in the proportion of one of the former to ten of the latter, but raw umber and a little Venetian red may be used instead.

*Dutch Pink.—A useful brown for scenic artists, but cannot be used in oil.

Fawn.—This might also be called deep drab. It is produced by tinting white lead with a mixture of French ochre, Indian red and lamp black, or raw Italian sienna and raw Turkey umber. Another shade of fawn is obtained by using eight parts of white lead, one part of chrome yellow, one part of Indian red, and one part of burnt umber ; or eight parts of white lead, two parts of medium chrome yellow, one part Venetian red, and one part of burnt umber.

* Fawn Brown.—A colour somewhat like raw Turkey umber, but richer. It was originally introduced by Messrs. Mander Brothers.

Fawn, Light.—Tint white with sienna and a touch of raw umber.

Foliage Brown.—Mix burnt umber with raw and burnt sienna and lighten with white as may be necessary.

*French Ochre.—This colour, of course, is bought ready made, and it must be observed that, in addition to the fineness, the particular tone of this colour is very important, especially to grainers.

Golden Brown.—Sixteen parts of white lead are mixed with one of burnt sienna and three parts of yellow ochre. A more brilliant colour is obtained by substituting zinc oxide for white lead.

Indian Brown.—Mix equal parts of Indian red, lamp black and yellow ochre.

Lava.—An orange brown lave shade can be got by mixing fifteen parts of black, five parts of orange, four of yellow, and a very little white.

Leather Brown.—Four parts of yellow ochre, three parts of Venetian red, two parts of white lead, and one part of blue black give a rich leather brown. If a lighter tint is required less black should be used. Or the following recipe may be used: mix white with three times the quantity of red and the same amount of yellow. Some painters use French ochre for a base and tint with burnt umber or Venetian red.

Light Lava.—A mixture of raw umber and raw sienna added to white will give this colour.

Lime Chocolate.—This is a speciality of Messrs. Mander Bros. It is suitable for mixing in water or oil and is very useful for all purposes of the decorative artist.

Light Oak.—Add French ochre and Venetian red to white as a base.

Lizard Bronze.—Fifteen parts of black, one of orange, five of yellow, and four of green will produce this dark greenish yellow shade.

*Madder Green.—A reddish brown madder shade is produced with one part blue, three parts each of orange and red, and six parts black.

Mahogany.—Mix orange and yellow in equal proportions with five times the quantity of black.

*Mander's Yellow.—An ochre colour made by

Messrs. Mander Bros. and intended to take the place of Oxford ochre.

*Mars' Brown.—An artist's colour, also called "Verona brown." It is an earth colour and is permanent and owes its colouring to ferric oxide and the degree of heat to which it has been subjected.

Mast Coloured Paint.—The following recipe gives good results. Mix twelve parts of genuine dry white lead with two parts of French ochre, two parts of grey barytes, and one part of genuine oxide of iron.

Nut Brown.—Equal quantities of red and yellow mixed with ten times as much black will give this shade.

Old Wood.—To get this shade mix one part of blue and red, two of orange and five of black.

Olive Brown may be made by mixing three parts of burnt umber and one part of lemon chrome yellow; or another shade is given by mixing equal quantities of orange and green with about twelve times as much black. Some painters add lemon chrome yellow to raw umber for a base. Lemon yellow and burnt umber gives a richer hue.

Orange Brown.—Two parts of orange chrome yellow mixed with three parts sienna.

Pomegranate.—A golden brown shade sometimes called by this name is given by mixing three parts of red, six of orange, four of yellow with twenty parts of black.

*Prairie Brown.—Mix together equal parts of orange chrome and Vandyke brown.

*Purple Brown.—The name of a well known cheap oxide. To imitate mix four parts of dark Indian red with one part of ultramarine blue and of lamp black. The addition of white lead will usually make a more satisfactory tint; if the shade is too purple, a similar quantity of blue should be added; if too red, more black may be used, or a little yellow added, but purple brown pigment is cheap.

*Raw Sienna.—Siennas are valuable earth colours most useful for staining or tinting, but practically useless as body colours. The degree of transparency determines to some extent the quality.

*Raw Umber.—A valuable earth colour. Also called Cyprus umber.

*Roman Ochre.—Also called "brown ochre." Red ochre toned down with black yields a substitute.

Rural Brown.—This is a useful and good wearing brown and is obtained by mixing three parts of Indian red, two parts of lamp black, and one part of chrome yellow.

Russet Brown.—Indian red lightened with white produces a tint sometimes called by this name.

Russet.—A very good russet shade is got by mixing twenty parts of black, twelve parts of red, ten of orange, three of yellow, and five of green. Or medium chrome green, raw umber, and a little orange chrome yellow added to white as a base will give an excellent russet.

Sandstone.—A tinting colour made by mixing raw and burnt umber will produce this colour.

Seal Brown.—Four parts burnt umber, one part golden ochre.

Sepia.—This is a natural colour used chiefly by artists and is made from a secretion of the cuttle fish. It cannot be imitated and it must not be used in oil.

Seville Brown.—A useful and cheap colour originally introduced by Messrs. Mander Bros. It may be used both in oil and water.

Siberian Brown.—Mix together equal parts of white lead and raw umber and brighten with a little Oxford ochre.

Sienna Brown.—This colour is variously called "sienna brown," "teak brown," and by other names. It is made by mixing burnt Italian sienna and French ochre with pure zinc.

SNUFF BROWN.—French ochre and Indian red added to zinc white will produce this colour. Another way to produce a snuff colour is to mix four parts of medium yellow and two parts of Vandyke brown, or burnt umber may be substituted for the Vandyke brown if desired. Another snuff colour may be obtained by mixing burnt umber and yellow ochre, tinging with a little Venetian red.

TAN.—Mix ten parts of burnt sienna and four parts of medium chrome yellow with three parts of raw umber. White lead and burnt sienna, to which has been added a very little lamp black, will also produce a tan colour. A very rich tan colour may be made from ochre, burnt Turkey umber and a little orange chrome with white lead.

THRUSH BROWN.—One part yellow ochre, three parts burnt umber, twelve parts white lead. The addition of a little black with less umber is sometimes used.

*TURKEY UMBER.—The richest variety of the many umbers on the market.

*VANDYKE BROWN.—This is an important brown to the decorator and is nearly permanent in oil, but fades a little in water. It cannot be imitated though a little red added to umber produces a colour somewhat similar to it. It is also called "Cassell Earth" and "Cologne Earth."

*VERONA BROWN.—An artist's colour, also called "Mars' Brown."

VIENNA SMOKE.—The best burnt umber should be tinted with lemon chrome yellow and a little Venetian red.

WALLFOWER BROWN.—This beautiful brown may be made by a mixture of medium chrome yellow and brown lake. Or crimson lake and burnt sienna may be mixed with medium chrome.

CHAPTER XII.

How to Mix Greys.

The saying that any colour can be used with grey is only partially true, because grey varies considerably in tone or shade of colour, and to obtain a successful result it is necessary that the colour used in conjunction should be of the same general tone as the grey itself.

By grey is generally meant a mixture of black and white, the latter predominating. When vegetable black or drop black is mixed with white, the result is a bluish grey, but when animal black, lamp black or ivory black is used, the colour has a brownish cast. A very little chrome yellow or burnt sienna added to black and white, gives a yellowish cast, which is useful when yellowish browns or reds are to be used in conjunction. But if bluish grey is required, a little Prussian blue or vermilion may be used instead, and with better results. Sometimes a little lake is added when mixing French grey, but there is a strong tendency for this to fade. Gas black, sometimes called "Carbon Black," gives a brownish cast when mixed with white. It is a very intense black and should therefore be used sparingly.

It should not be forgotten that greys may be produced not only by an admixture of white and black, with or without a little blue and red, but there are many other useful greys of more definite characteristics. For instance, in water colour, Indigo mixed with either Venetian red, Indian red, burnt umber and lathe, or lake and gamboge will yield greys without the addition of white, as will also black and lake.

The reader who is interested in the subject is advised to make a series of experiments in the following way :— He should take either white lead or zinc oxide—the latter in preference—ground in oil and then mix small quantities of the different blacks mentioned above with the white. The mixtures should be painted out side by side, the particular black used being wriften against each sample. This will give at once a demonstration of how the various colours produce a bluish or brownish cast as above referred to. The best material on which to work is a piece of Compo-board, or a series of small pieces, is that one can be put up against the other by way of comparison when desired.

Proceeding with the experiment, take a grey which has a yellowish cast, add a little French ochre to one sample and to another a little burnt umber; to a third, a mixture of both; then a little raw umber and still another; a little chrome yellow. Mix up thoroughly and paint as before, again writing against each sample the name of the colours used. It will be understood that only a very little of the colour is to be used, because if much is employed the tone will be destroyed.

The next thing to be done is to deal with the grey, which has a bluish cast, in exactly the same manner, but in this case instead of using burnt sienna, etc., we shall use a very little blue and a very little red, or a little ultramarine if zinc oxide is used, but not if white lead is being experimented with. The red may be vermilion or Venetian red. Again it may be urged that only a very little of the colour may be used.

Now, as a final experiment, paint a strip of fairly strong colour, being a yellow or brownish shade, and then a similiar colour having a bluish or greenish cast; place these against all the other colours, and a comparison between the two will show which harmonises the best. It must be remembered that black and pure white forms the foundation of most greys.

Checker patterns of both black and white squares can often be used with good effect on the front of buildings finished in grey. The sash frames may be painted white and the sashes in bright colours, such as in cherry red, which will not be found too bright, as there is little of it actually used.

Greys, relieved with white, are rapidly growing in favour as a finish for the front of houses, not only in the West End of London, but also at the seashore—Brighton, for example. It looks much better and lasts much longer than stone colours.

If greys are used on interior work, in most cases it will be found desirable to introduce colour in some form, or otherwise the decorations must be considered to be somewhat cold and cheerless. If the walls are grey, there is no difficulty in introducing colour by means of a plain or cut out frieze, or border, or by the use of up-to-date colour schemes introduced in the shape of bunches of flowers or foliage which are placed in suitable positions here and there, and have the appearance of springing up out of the skirting board. For a similiar room where a number of pictures are to be hung, it is quite a good idea to distemper or paper the walls in a warm grey, and to use a narrow border of bright colours. A room facing the north should not be decorated in this way however, but a primrose or golden brown should be used on the walls instead, with the object of creating a warmer and more comfortable appearance.

Grey wears well, but the blacks used in its composition are almost invariably bad driers, and therefore a sufficient quantity of a good liquid drier should be added to correct this characteristic.

Although the dictionaries do not usually distinguish between the spelling of "grey" and "gray," and although many decorators use the two words indiscriminately, there is a distinct difference which it is both convenient and advisable to recognise. A "grey" is an admixture of black and white, and may vary

from the smallest quantity of black added to white to the other extreme, where there is almost as much black as white. Anything between the two would be termed a "grey." Examples of this are found in the list which follows under heads such as: Dark lead, dark slate, lead, etc. When a colour is added to the black and white the admixture is called a "gray," provided, of course, that the black and white predominate; for example, a French gray is made by tinting white with a little ivory or drop black and adding a little carmine or crimson lake or ultramarine. It will be seen that the addition of the lake or ultramarine gives it a peculiar warmth which distinguishes French gray, and changes the spelling from "grey" to "gray." Gray drabs are those in which a grey is coloured up to produce a yellowish tinge. Black being usually a strong tinting colour, care must be taken that it is used in moderation, and here the importance of adding a small quantity at the time, as already observed, will impress itself on the operator. After the shade desired has been obtained the colour should be added until the desired warmth is arrived at.

The experiments advised in previous chapters may be continued with advantage in respect to blacks which will be found when mixed with white to possess certain characteristics which should be known to every colour mixer. The blacks which should be experimented with are ivory black, vegetable black, lamp black and blue black. It will be noticed that pure ivory black, for example, gives a distinct bluish cast, while lamp black is of a somewhat browner hue. Gas black, which is often mixed with other blacks, gives a brownish cast.

Argent.—A reddish gray tint, which can be produced by mixing together nine parts of black, sixteen of white, one of red, and a little orange.

Ash Gray.—Lamp black and a little French ochre added to white lead give this colour. Another mixture

is as follows: two parts of burnt sienna, three parts of light ultramarine blue, sixty parts of zinc white.

BLACK SLATE.—Mix together black and Prussian blue in the proportion of about thirteen parts of the former to one of the latter and add white.

*CHARCOAL GRAY.—Another name for Blue Black, which see. Sometimes it is a special grey prepared from charcoal and is then only suitable for water.

DARK GRAY.—Mix eight parts of black, one of white and a touch of red or blue to produce this shade; but practically any admixture of black and white in which the former predominates and to which has been added a little colour will give a dark gray.

DARK LEAD.—This is a dark grey, being produced simply by adding lamp black to white lead.

DARK SLATE.—This also is black added to white. The admixture under "Black Slate" would answer.

*DAVY'S GREY.—This colour is made by Messrs. Winsor and Newton from soot and is recommended as a reducing agent as it does not, like the blacks, sully the colours with which it is mixed, but gives pure and translucid effects and is a capital drier.

DEEP LEAD.—Black, a little bright blue and Indian red mixed with white lead produces this colour.

FRENCH GREY.—This can be made by tinting white with a little ivory or drop black and adding a little carmine or crimson lake and ultramarine. This produces a very slight violet tinge. White tinted with a little ultramarine and Venetian red also gives a good French grey. Celestial blue or cobalt may be used instead of the ultramarine if desired. Another good mixture is made by tinting white lead with one part of black and two parts of orange chrome. Perhaps the simplest method of all is to thin white with bright Indian red.

GRANITE.—French ochre and lamp black added to white lead produce this colour.

GRAYSTONE.—Mix five parts of black with three of white and three of blue and add a little red.

GRAY DRAB.—Mix five parts of black with four of white and a little deep chrome yellow.

GRAY (WARM).—See warm gray.

GREEN SLATE.—Same as lead, but with more black and blue.

IRON GRAY.—Mix eight parts of black with two of white and a little orange.

JASPER.—This may be described as "a pepper and salt shade." Mix nine parts of black with two of white, with a touch of deep chrome.

LEAD.—This is simply a dark gray, and is made by adding lamp black to white lead with sufficient blue.

LIGHT GRAY.—Mix together one part of Prussian blue, one part of lamp black, ten parts of white lead. By adding more or less white lead a darker or a lighter shade may be obtained if required. Another shade is obtained by mixing two parts of black, eight parts of white and one part of blue.

MASTIC.—This is a dark gray shade. To produce it mix twelve parts of black with one of white, rather less than one of yellow and just a touch of orange.

*MINERAL GRAY.—An artist's colour sometimes called "Ultramarine Ash."

MOSS GRAY.—Tint white lead with French ochre, a bright green and a little lamp black.

MOUSE COLOUR.—Eleven parts burnt umber, to which has been added one part of Prussian blue, mixed with about twenty times the bulk of white lead, will give this tint. Another shade may be had by mixing sixteen parts of white, three of black and one of blue. Some painters tint white with lamp black and add a very little Venetian red and burnt umber.

*NEUTRAL TINT.—An artist's water colour is sold under this name. It is somewhat similar to Payne's Gray, and is made from a mixture of carbon black, ochre and French ultramarine.

OLIVE GRAY.—Three parts of lamp black, one part chrome green, with about forty times the quantity of white lead, will give this colour.

OPAL GRAY.—One part of burnt sienna, two parts of cobalt blue, and thirty parts of zinc white.

*PAYNE'S GRAY.—Is an artist's colour, which may be described as a gray having a lilac tinge. See neutral tint.

PEARL.—This is the same as French gray, but is much lighter.

PEARL GRAY.—Forty parts white lead, five parts of vermilion and one part of deep chrome green. Some decorators tint white lead with lamp black and call that pearl gray. Strictly speaking, however, it should be called pearl grey, there being no colour present. Six parts of white lead, two parts of Venetian red, and one part of lamp black gives a somewhat dark pearl gray, but a lighter tint may easily be obtained by adding more lead. Ivory black answers equally as well as lamp black.

QUAKER DRAB.—This greenish gray shade is produced by mixing two parts each of yellow and green and five parts of white.

RUSTIC DRAB.—Tint white lead with French ochre and lamp black.

SILVER GRAY.—Tint white lead with French ochre and lamp black, or yellow may be employed instead of the ochre if preferred. White lead tinted with a little lamp black and indigo gives an excellent silver gray.

SLATE.—See "Dark Slate."

SMOKE GRAY.—Tint white lead with French ochre and lamp black.

STEEL GRAY.—Tint white lead with a mixture of lemon chrome and medium chrome and lamp black.

STONE GRAY.—Add black and chrome to white lead.

*Ultramarine Ash.—An artist's colour sometimes called "Mineral Grey."

Verdant Grey.—Two parts of oxide zinc and one part of terra verte.

Warm Gray.—Tint white lead with French ochre and lamp black or sienna and lamp black. A better mixture is produced by taking white as a base and adding a little burnt sienna and raw umber with a very little burnt umber and a touch of Prussian blue.

Blue-Grey.—Zinc oxide with a little ivory black and just a touch of Prussian blue.

Steel Grey.—Lithopone, yellow ochre, black and a touch of blue gives this colour, but the quantity of white must largely predominate.

CHAPTER XIII.

WHITES AND BLACKS.

Although neither blacks or whites can strictly be called colours, yet they are both used largely in paint mixing. A list of the principal varieties is therefore included for reference.

Blanc Fixe.—Artificial barytes, or sulphate of barium. A white pigment which enters largely into the composition of Orr's white, lithopone, etc., and is principally used in paper making, and in the manufacture of wall-paper colours.

Charlton White.—See Orr's zinc white.

Chinese White.—Another name for zinc oxide, but applied to the water colour, *i.e.*, zinc ground in water.

Constant White.—Similar to blanc fixe. It consists of sulphate of barium ground in water. It is not suitable for grinding in oil, being very deficient in body.

Cremnitz White.—Another name for flake white (*q.v.*) but strictly applied to even a finer preparation than ordinary flake white.

Blanc d' Argent.—See Flake White.

Dutch White.—Is a mixture of three parts of barytes to one part of white lead. Note the difference between Dutch white and Dutch process white lead.

Flake White.—This is the name usually applied to white lead which is specially prepared for the use of artists. Chemically, it is basic carbonate of lead, or hydro-carbonate of lead. It is not used as a water

colour as it discolours very rapidly. The best flake white may be taken as a perfect example of white lead, and is often used for comparison. Flake white is also known as Cremnitz white, blanc d'argent, and silver white.

FOUNDATION WHITE.—A mixture of high grade white lead as used in the manufacture of artists' flake white, with another white lead of inferior quality. Although a pure white lead, it is not equal in density to flake white. It is, however, cheaper, and is sometimes employed by artists as a foundation on their canvases.

FREEMAN'S WHITE.—A mixture of sulphate of lead, zinc oxide, and barytes.

MISCELLANEOUS WHITES.—Zinc oxide is sold ground in refined linseed oil, about thirty-five gallons being required to the ton. It is also sold mixed with barytes, china clay, sulphate of lime, etc., in varying proportions according to the price it is to be sold at. The same is true with white lead. Genuine lead requires about a gallon of refined linseed oil to one cwt. of lead. White barytes in various proportions are mixed with it to produce reduced white leads.

ORR'S ZINC WHITE.—A white pigment consisting of zinc sulphate and zinc oxide, combined with about 70 per cent. of artificial barytes or barium sulphate. It is largely used in the manufacture of washable water paint by wall-paper manufacturers, etc. It is substantially the same as Charlton white.

OXIDE OF ZINC.—A white pigment which possesses the advantage of being much whiter and finer than lead, and being also free from poisonous effects. It is unaffected by sulphureted hydrogen and other gases, and is used in growing quantities in recent years.

PEARL WHITE.—Basic nitrate of bismuth.

PERMANENT WHITE.—Another name for zinc oxide when ground in oil. The term is sometimes applied to blanc fixe or artificial barytes.

PROCESS WHITE.—A special white ground in water, and essentially the same as blanc fixe (*q.v.*) It is prepared by Messrs. Reeves and Sons, principally for use in drawings prepared for reproduction, and is permanent.

SULPHATE OF LEAD is sometimes called Sublimed Lead.

VENICE WHITE.—Venice white is made by mixing equal parts of barytes and white lead.

WHITE LEAD.—This is the most important white used by painters. It is now made in a variety of ways, but no method seems to supplant that which is known as the old Dutch "stack" process, which is carried out strictly by such firms as Walker, Parker and Co., Foster, Blackett and Wilson, Alexander Fergusson and Co., John Hare and Co., the Mersey White Lead Co., and several others. A great deal of white lead is imported from the Continent, and it is mostly of inferior quality, being as a rule coarsely ground. Chemically, white lead is basic carbonate of lead, and an analysis of an average example shows that it contains roughly speaking two-thirds of lead carbonate, and one-third hydrate. The method of testing white lead will be found described under the head of testing colours.

ZINC WHITE.—Pure oxide of zinc, also called "Chinese White," "Constant White," and "Permanent White." The term is sometimes applied to a class of whites of which Orr's zinc white, Charlton white, and lithopone are examples. See also Oxide of Zinc.

ZYLOTHIN.—A white manufactured by Messrs. Baiss Brothers and Stevenson, Ltd.

BLACKS.

The chief blacks used by decorators and artists are lamp black, ivory black, and blue black. Painters who realise the desirability of using pure tinting colours generally, sometimes seem to think that any

black may be used, irrespective of whether it is pure or not. This is a great mistake, as it is just as essential that blacks be pure, as any other stainers. It may be added that some manufacturers make certain of their bone blacks, usually sold as "Drop Black" from selected parts of the same description of an animal. Thus a drop black sold by a well known American house is guaranteed to be made only from the skull and shin bone of the sheep.

ANIMAL BLACK.—This is made by burning various animal products.

BLUE BLACK.—Blue black in water colour is sometimes called charcoal gray, which see. This black should be made from shoots of vine, beech, and other woods, but more frequently it is simply a bone black, or a lamp black, to which has been added a little indigo.

BONE BLACK.—This is made from various bones, charred, ground, dry washed, then ground in oil.

CARBON BLACK.—This is a very intense black, which is rarely sold under that name, but is used by some paint manufacturers to give strength to other blacks. It is derived from the combustion of petroleum residue.

DROP BLACK.—This is another charcoal black sold in the form of drops, or irregular cones. Some painters appear to consider that this particular form prevents the adulteration. As a matter of fact, the drops are produced by the pigment dropping slowly from the mill as it is ground, and if it were desired to adulterate, the material could be added in the mill.

FRANKFORT BLACK.—This is another name for drop black.

IVORY BLACK.—This is made, as the name implies, from charred ivory chips. Most of the so-called ivory blacks on the market, however, are a fine grade of bone black.

LAMP BLACK.—This useful black is made by the combustion of waste oils, principally those derived

"NAYRODEC" WATER PAINT.

2512 PRIMROSE.

2519 PALE GREY.

2530 MIGNONETTE.

2521 PERSIAN RED.

2532 SKY BLUE.

2535 MYOSOTIS BLUE.

NAYLOR BROTHERS (LONDON) LIMITED,
SLOUGH, BUCKS.

from coal-tar distillation. Lamp black gives as a rule, a warm and somewhat brownish hue, and is quite permanent both in oil and water.

MINERAL BLACK.—Mineral black may be described as powdered coke. It is used principally in cheap black paints.

VEGETABLE BLACK.—Vegetable black may be described as a superior class of lamp black.

CHAPTER XIV.

TWO HUNDRED STANDARDIZED COLOURS.

As explained elsewhere, the French Society of Chrysanthemumists issued an elaborate and most useful set of plates of standardized colours of fruits, flowers and foliage. These are, of course, equally suitable for the use of decorators and artists.

All the colours in this collection of plates which do not occur in the foregoing chapters have been carefully matched by Mr. C. E. Oliver in conjunction with the author. The pigments employed to produce these colours are set out below. Although the proportions cannot be stated, for reasons which have already been given, some idea of them may be gained by the order in which they are stated. The largest amount used is named first, the second largest second, and so on. Thus, where several pigments are employed, the one mentioned last would be used very sparingly.

NOTE.—The term "Zinc White" in any case means pure zinc oxide, This is used in preference to white lead, because the purity of tint is considerably enhanced.

REDDISH APRICOT.—Zinc white, burnt sienna, orange chrome.

BISTRE.—French ochre, orange chrome, burnt sienna.

DEEP BISTRE.—Bistre, deep, French ochre, zinc white, burnt sienna, toned with black.

GREENISH BLACK.—Black toned with middle chrome, green and zinc white.

PURPLE BLACK.—Black toned with crimson lake and vermilion.

REDDISH BLACK.—Black, burnt sienna.

VIOLET BLACK.—Black toned with crimson lake and French ultramarine.

CORNFLOWER BLUE. — Zinc white, French ultramarine toned with Prussian blue.

DELFT (or DUTCH) WARE BLUE.—Zinc white, black, Prussian blue, mid chrome green.

FLOSS FLOWER BLUE.—Zinc white, French ultra marine, crimson lake, toned with black.

LAVENDER BLUE.—Zinc white, French ultramarine, crimson lake, toned with black.

LOBELIA BLUE.—Zinc white, French ultramarine, crimson lake.

NORMAL BLUE.—French ultramarine, zinc white, toned with Prussian blue.

SEVRES BLUE.—Emerald green, zinc white, Prussian blue toned with black.

SMALT BLUE.—Zinc white, Prussian blue toned with vermilion.

VICTORIA BLUE.—French ultramarine, zinc white, Prussian blue.

PALE BLUSH.—Zinc white, French ochre, orange chrome.

BLOOD RED BROWN.—Vermilion, orange chrome, black, crimson lake.

MADDER BROWN.—Zinc white, burnt umber, burnt sienna, madder lake.

MINERAL BROWN.—Zinc white, burnt sienna, burnt umber.

BUFF.—Zinc white, French ochre, mid chrome yellow, burnt sienna.

PALE BUFF.—This might be called "Nankin Yellow." Zinc white, orange chrome, burnt sienna, mid chrome yellow.

CADMIUM LEMON YELLOW.—Zinc white, mid chrome yellow toned with mid chrome, green and orange chrome.

ORANGE CADMIUM.—Zinc white, orange chrome, pale chrome yellow.

YELLOW CADMIUM.—Pale chrome yellow, zinc white, chrome yellow deep.

DEEP CADMIUM YELLOW.—Zinc white, orange chrome, pale chrome yellow, scarlet vermilion.

CADMIUM YELLOW LIGHT.—Pale chrome yellow, zinc white, chrome yellow deep, toned with Ripolin yellow.

MADDER CARMINE.—Crimson lake, carmine, zinc white, orange chrome.

SALMON CARMINE.—Zinc white, scarlet vermilion, orange chrome, crimson lake.

DEEP CERISE.—Zinc white, crimson lake, vermilion.

CHAMOIS.—Zinc white tinted with French ochre.

CLARET.—Crimson lake, zinc white, vermilion.

BROWNISH DRAB—This might be called TOBACCO BROWN.—Zinc white, burnt sienna, burnt umber, toned with black.

PALE ECRU.—Zinc white, French ochre, orange chrome.

FLESH COLOUR.—Zinc white, burnt sienna, vermilion.

PALE YELLOWISH FLESH.—Zinc white tinted with French ochre and burnt sienna.

GALLSTONE.—Middle chrome yellow, orange chrome.

GARNET BROWN.—Crimson lake, zinc white, mid-chrome yellow toned with black.

GARNET DULL.—Crimson lake, zinc white, scarlet vermilion, French ultramarine.

PURPLE GARNET.—Zinc white, crimson lake, vermilion, French ultramarine.

ARTICHOKE GREEN.—Zinc white, French ochre, mid-chrome green toned with black.

BISTRE GREEN.—Zinc white, French ochre, pale chrome yellow, toned with black.

BOX GREEN.—Middle chrome green, deep chrome deep.

CEDAR GREEN.—Zinc white, mid-chrome green, black, deep chrome yellow.

CYPRUS GREEN.—Mid chrome green, mid chrome yellow, toned with black.

JASPER GREEN.—Chrome green deep, chrome green pale.

LETTUCE GREEN.—Zinc white, mid chrome green, pale chrome yellow, oxford ochre.

MINERAL GREEN.—Zinc green light, zinc white.

RUSSET GREEN.—Zinc white, French ochre, pale brunswick green, mid chrome yellow.

SKY GREEN.—Zinc white, zinc green light, pale chrome yellow.

SLATE GREEN.—Zinc white, French ochre, mid brunswick green.

SPINACH GREEN.—Mid chrome green, mid chrome yellow, toned with black.

VERDANT GREEN.—Zinc white, middle chrome green, middle chrome yellow.

VERDIGRIS.—Zinc white, mid chrome green, Prussian blue.

VERONESE GREEN.—Zinc white, emerald green, prussian blue.

YELLOW GREEN.—Primrose yellow and zinc white, mid and orange chrome, mid chrome green.

GREENISH GREY.—Zinc white, black, middle chrome green.

IRON GREY.—Zinc white, black burnt umber, toned with mid chrome green.

PAYNES GREY.—Zinc white, black, toned with crimson lake.

HAZEL.—French ochre, zinc white, middle chrome yellow.

GREYISH INDIGO.—Zinc white, black, prussian blue.

PLATE INDIGO.—Zinc white, black, prussian blue, mid chrome yellow.

BROWN LAKE. This is really a lake brown.—Orange chrome, burnt sienna, crimson lake.

CARMINE LAKE.—This might be called a CARMINE LAKE TINT.—Crimson lake, carmine, vermilion, and zinc white.

GERANIUM LAKE.—Crimson lake, vermilion.

MADDER LAKE.—This might be called MADDER LAKE TINT—Vermilion, crimson lake, madder, zinc white and orange chrome.

DULL PURPLE LAKE.—Zinc white, crimson lake, vermilion, French ultramarine.

YELLOW LAKE.—Middle chrome yellow, burnt sienna, prussian blue.

RED LEAD.—To imitate red lead, orange chrome toned with vermilion.

DEAD LEAF.—Zinc white, burnt sienna, toned with French ultramarine.

BLUISH LILAC.—Zinc white, crimson lake, French ultramarine, vermilion.

REDDISH LILAC.—Zinc white, vermilion, crimson lake, French ultramarine.

SALMON LILAC.—Zinc white, vermilion, crimson lake, toned with ultramarine.

VIOLET LILAC.—Zinc white, crimson lake, vermilion, French ultramarine.

MOUSE COLOUR.—Zinc white, black raw umber, burnt sienna,

CHINESE ORANGE.—Orange chrome, middle chrome yellow.

COPPERY ORANGE RED.—Zinc white, orange chrome, mid chrome yellow, burnt sienna.

NEUTRAL ORANGE.—Orange chrome, burnt sienna.

RUSSET ORANGE.—Orange chrome, vermilion, zinc white.

SCARLET ORANGE.—Orange chrome, vermilion.

PEACH BLOSSOM.—Zinc white, scarlet vermilion, toned with black.

HYDRANGEA PINK.—Zinc white, scarlet vermilion, toned with black.

ROSY PINK.—Zinc white, crimson lake, vermilion, orange chrome.

FRENCH PURPLE.—Crimson lake, zinc white, French ultramarine.

VINOUS PURPLE.—Zinc white, crimson lake, ultramarine toned with black and vermilion.

PUTTY COLOUR.—Zinc white, French ochre, toned with raw umber.

ANTIQUE RED.—Zinc white, burnt sienna, crimson lake, scarlet vermilion.

CARDINAL RED.—Scarlet vermilion, crimson lake.

CORAL RED.—Zinc white, vermilion, orange chrome.

COPPERY RED.—Zinc white, scarlet vermilion, burnt sienna, crimson lake.

CURRANT RED.—Vermilion, zinc white, crimson lake.

ETRUSCAN RED.—Zinc white, scarlet vermilion, burnt sienna.

FIERY RED.—Vermilion toned with orange chrome,

LINCOLN RED.—Scarlet vermilion, crimson lake. zinc white.

PEACH RED.—Zinc white, burnt sienna, scarlet vermilion, crimson lake.

RASPBERRY RED.—Zinc white, vermilion, crimson lake.

ROSE NEYRON RED.—Zinc white tinted with carmine. A slightly inferior tint from madder lake.

STRAWBERRY RED.—Crimson lake, vermilion.

TOMATO RED.—Vermilion, crimson lake, orange chrome.

TURKEY RED.—This might be called ORIENT RED. Vermilion, madder lake, or vermilion, crimson lake, orange chrome.

RESEDA GREEN.—Zinc white, French ochre, pale Brunswick green, raw umber.

LILAC ROSE.—Zinc white tinted with crimson lake.

MAUVE ROSE.—Zinc white, crimson lake, orange chrome.

BRONZY OLD ROSE.—Zinc white, crimson lake, scarlet vermilion toned with black.

BLUE SLATE.—Zinc white, black, mid chrome green, Prussian blue.

Slate Violet.—Zinc white, vermilion, crimson lake, toned with black.

Stone Colour.—Zinc white, French ochre, pale chrome yellow, raw umber.

Tan Colour.—Burnt sienna, middle chrome yellow, orange chrome.

Bluish Violet.—Zinc white, French ultramarine, crimson lake.

Bright Violet.—Zinc white, crimson lake, French ultramarine.

Parma Violet.—Zinc white, crimson lake, French ultramarine, toned with black.

Plum Violet.—Crimson lake, zinc white, French ultramarine.

Reddish Violet.—Zinc white, crimson lake, French ultramarine.

Violet Slate.—Zinc white, vermilion, crimson lake, toned with black.

Amber White.—Zinc white, pale chrome yellow, ochre, mid chrome green.

Creamy White.—Zinc white, French ochre, pale chrome yellow.

Fleshy White.—Zinc white tinted with French ochre and burnt sienna.

Greenish White.—Zinc white, pale chrome yellow, pale chrome green.

Lilac White.—Zinc white tinted with French ochre, crimson lake, and cobalt blue.

Milk White.—Zinc white tinted with French ochre.

Purplish Tinted White.—Zinc white, burnt sienna, French ultramarine.

Rosy White.—Zinc white tinted with ochre, orange chrome and crimson lake.

Sulphury White.—Zinc white, pale chrome yellow, pale chrome green.

Sky Coloured White.—Zinc white, French ochre, pale chrome green.

YELLOWISH WHITE.—Zinc white, yellow ochre, mid chrome yellow.

COPPERY YELLOW.—Mid chrome yellow, mid chrome green, zinc white, burnt sienna.

HONEY YELLOW.—Zinc white, French ochre, mid chrome yellow.

PYRETHRUM YELLOW.—Primrose yellow and zinc white.

SAFFRON YELLOW.—Zinc white, orange chrome, pale chrome yellow, scarlet vermilion.

SUNFLOWER YELLOW.—Pale chrome yellow, zinc white, chrome yellow deep, Ripolin yellow, permanent Dutch pink.

YOLK YELLOW.—Lemon chrome, orange chrome, mid chrome green.

SULPHUR YELLOW.—Zinc white, mid chrome yellow, mid chrome green, orange chrome.

WEDGWOOD GREEN : This colour may be described as a light neutral green having a warm grey tone. The stainers necessary for producing the colour are very simple, being French ochre, middle chrome, green and black. These should be combined to form an olive green, and then be added to zinc oxide. A fair quantity of ochre, but very little of the middle chrome green and black will be required. Another method would be to stain zinc oxide with ochre to produce a light buff, then to add sufficient green to give it a green cast, and finally to tone it down with black. When using this colour in large masses, it is well to keep the colour well on the light side.

WEDGWOOD GREY is produced in the same way as Wedgwood green described under the head of "Greens," but the proportion of green actually added should be very small indeed. When used in large masses, it is advisable to keep this colour well on the light side.

CHAPTER XV.

GROUND COATS AND FLATTINGS.

There is a considerable difference of opinion as to the correct method of making up a ground coat suitable for flatting, and what difference in colour if any, there should be between the two.

Some affirm that the ground coat should be two or three shades deeper than the flatting, while others say they prefer it to be lighter.

Except in a few special instances which we shall presently mention, we do not agree with either of these.

In the first place, it is a waste of time to make up two lots of colour for one job, and there is no reason why sufficient paste colour should not be stained for both the ground and the flatting, before the thinnings are added. A portion of this can be thinned with, say, half and half oil and turps and applied as a ground coat, while the second portion is thinned with turps for the finish.

There will be just sufficient difference in colour to show where the brush has gone, because all colours deepen to some extent during the time of drying. On applying the flatting, it will appear a trifle lighter than the ground, but will go down to it and produce a solid job.

Should any slight alteration in hue be necessary, it can be seen when the ground coat is on and rectified in the finish without much danger and with a greater

degree of certainty than would be the case were the colour to be made entirely the second time.

The same system may be employed for an oil finish, the only difference being that the coatings are reversed and the flatting goes on first.

The principal exception to this method of procedure is in the production of transparent or semi-opaque finishes, when as explained elsewhere, the ground coat must be solid, and invariably be several shades lighter than the finishing colour.

THE CHOICE OF A STAINER.

The majority of colour samples may be matched by more ways than one, and it is always a good rule to follow, to choose the most simple mixture that will produce the correct result.

There is one point to consider however when one has the choice of two or more stainers, and it has reference to the question of the opacity or the transparency which any particular colour possesses, and which, to some extent, determines its suitability for a given purpose.

OPACITY VERSUS TRANSPARENCY.—When making up a paint which it is desired shall cover well, or produce a good solid ground coat, the stainers employed must be chosen with that end in view, and transparent colours be omitted as far as possible.

On the other hand, it is necessary at times to choose stainers which are not opaque, and the effects to be obtained are due entirely to the degree of transparency which the stainers possess. For a graining colour, and for semi-transparent stipple effects, a stainer coming under the head of semi-opaque would be the most suitable. For stains and glazes the transparent colours would be chosen.

The following list will serve as a guide :—

OPAQUE COLOURS.—Chrome pale, middle, deep and orange. Yellow ochre, vermilion, Indian red, Venetian red.

Semi-opaque Colours.—Raw sienna, raw and burnt umber, Turkey red, Tuscan red.

Transparent Colours.—Prussian blue, ultramarine cobalt blue, burnt sienna, crimson lake.

When a large quantity of transparent pigment enters into the composition of a finishing paint which is intended to produce a solid effect, it is most important that the ground colour be exactly right. It should be as near the finishing colour as it is possible to attain by the use of solid or opaque colours, but it should be two or three shades lighter, to allow for the darkening effect which always attends the use of transparent paints.

CHAPTER XVI

Colour Glazing.

Although the art of glazing in painted work is not strictly a part of paint and colour mixing, yet it has a direct bearing on the subject, because of the effects which may be produced by its use. Glazing may be defined as a method used in oil painting by which a brilliancy of finish is obtained by means of a coat of a bright but transparent colour applied over another colour having much less brilliancy but much more body.

A simple example of the principle of glazing is found in the finish of ordinary green work, which is to receive a final bright coat. Here the painter usually gives two or more solid coats of slate or gray colour, and upon this paints his green, the slate showing through the final green coat to some extent, and a good solid green is the result. If green had been used from the foundation up, one or two more coats would have been needed.

The following are some of the effects which can be produced by means of glazing. A series of beautiful reds, such as wine colour, may be obtained by giving three coats of Indian red mixed with orange chrome in proportions varying according to the finish required, and finally giving a glazing coat of crimson lake, madder or carmine.

The reader will readily see that a great variety of colours may be obtained by varying the ground ; thus,

a bright orange glazed over with crimson lake gives a very bright effect, while either Indian red, Venetian red, Tuscan red, or other deep reds may be mixed with yellow or used plain as an underground for the glazing colour.

Sometimes a reddish, purplish colour is desired in the finish. This can be obtained without difficulty on a ground of Indian red mixed with a little orange chrome, and a glazing colour of purple madder. Various rich effects in blue may be obtained by applying a thin wash of Chinese blue over a deep green ground. Here again by varying the tone of the ground still different results may be obtained.

Some beautiful peacock greens and blues may be obtained on a ground of Brunswick green and chrome, by glazing with Prussian blue and lemon chrome. Deep amber may be obtained on a ground of middle chrome and a glaze of burnt sienna and orange.

A word may be said here as to the scumbling and glazing. Both processes are similar up to a certain point, which is that in both cases one colour is placed over another of good body. In glazing the top colour is transparent; in scumbling, it is solid, and a portion of the top is usually wiped off or removed, so as to expose a part of the colour beneath. The simplest example which can be given of scumbling is grained work, which is really wholly a process of scumbling; but a better example is the finish so often given to relief decoration, when a mixture of the brown, say, sienna and umber, is applied over a much lighter ground finished, say, to an ivory finish. The top colour being wiped off at the edges of the relief and elsewhere, an antique effect is the result. In ordinary plain painting, this effect is sometimes produced in panelled work, and some pretty effects may be produced. For example, a rich ultramarine blue painted over with a thin glazing of yellowish white and partly removed, gives a very pretty effect.

It is a little surprising that glazing is not used more among decorators than it is. It is true that often glazing colours are expensive, such as, for instance, carmine and madder, but the actual amount of colour used is small, so that the cost of materials when compared to the excellence of result obtained is trifling.

The student of colour effects in decoration is recommended to experiment on the lines above indicated. Much will depend, of course, upon the artistic sense of the operator, but by experimenting with different transparent colours on various grounds, many unexpected and novel effects will be produced, which become valuable in the execution of high-class work, particularly so in these days when plain and often sombre hued wall coverings are so much in vogue.

From what has been said it will be clear to the reader that some excellent results may be obtained by a good colourist by a judicious use of a brilliant glazing colour over a more subdued and perhaps cheaper colour of good body beneath. But there are other effects obtainable by means of an ordinary brush and the use of colours, specially adapted for the purpose. Graining may be looked upon as a description of glazing as already stated, because one colour shows through the other.

The following list of glazing colours with the grounds which are suitable is reprinted from "Scumbling and Colour Glazing," by Andrew Millar, published at 6s., by The Trade Papers Publishing Co., Ltd., 301, Bank Chambers, 329, High Holborn, London, W.C. 1. The book contains many plates showing examples of glazing and brush graining in actual paint.

The subject of colour glazing is dealt with in a practical manner and at considerable length in "Scumbling and Colour Glazing," by Andrew Millar, the second edition of which is published by The Trade Papers Publishing Co., Ltd., 301, Bank Chambers, 329, High Holborn, W.C., at 6s. This book is illustrated with many different specimens of glazing, brush graining,

etc., in colour. The following list of colours with the ground and glazing colours are taken from the book referred to, by permission of the publishers :—

REDS.

Name of Colour.	*Ground Colours.*	*Glazing Colour.*
APRICOT.	White Lead, Mid. Chrome, Vermilionette.	Crimson Lake.
BEGONIA.	White Lead, Vermilionette, Prussian Blue.	Brown Madder Lake.
CARNATION.	White Lead, Vermilion.	Crimson Madder Lake.
CLARET.	White Lead, Venetian Red, Vermilion, or Zinc Oxide and Ultramarine Blue and Carmire.	Brown Madder Lake.
CORAL.	White Lead, Vermilion and Lemon Chrome.	Crimson Lake.
FLESH COLOUR.	White Lead, Yellow Ochre, Venetian Red.	Burnt Sienna.
GERANIUM.	Bright Derby Red, Orange Chrome.	Crimson Lake.
LILAC.	White Lead, Vermilion, Ultramarine Blue.	Brown Madder Lake.
MAGENTA.	Zinc Oxide and Ultramarine Blue.	Crimson Lake.
PEACH.	Zinc Oxide, Vermilion and Lemon Chrome, or White Lead, Venetian Red.	Cadmium (deep). Carmine.

Name of Colour.	*Ground Colours.*	*Glazing Colour.*
Plum.	White Lead, Indian Red, Ultramarine Blue, or White Lead, Indian Red.	Carmine. Ultramarine Blue.
Pomegranate.	White Lead, Venetian Red and Lemon Chrome.	Burnt Sienna.
Russets.	Venetian Red, Orange Chrome, Lemon Chrome.	Emerald Green (thin).
Rose.	Zinc Oxide and Vermilion or White Lead, Lemon Chrome.	Crimson Lake. Carmine.
Terra Cotta.	White Lead and Venetian Red.	Burnt Sienna.
	Blues.	
Azure Blue.	Zinc Oxide and Ultramarine Blue.	Cobalt.
Bronze Blue.	White Lead and Prussian Blue.	Black Japan.
China Blue.	Zinc White, Cobalt and Raw Sienna.	Indigo.
Gobelin Blue.	White, Blue-black, Prussian Blue.	Emerald Green.
Marine or Sea Blue.	Ultramarine, ivory Black or White, Raw Sienna and Cobalt.	Cobalt. Indigo.
Metallic Blue.	Zinc White and Cobalt, or Zinc Oxide, Prussian Blue Black.	Emerald Green. Indigo.

Name of Colour.	*Ground Colours.*	*Glazing Colour.*
MAUVE.	Zinc Oxide and Cobalt, or Zinc Oxide and Celestial Blue.	Carmine. Carmine.
PEACOCK BLUE.	Zinc Oxide and Ultramarine, or Zinc Oxide and Prussian Blue.	Emerald Green. Cobalt.
TURQUOISE.	Zinc White and Cobalt.	Emerald Green.
WEDGWOOD.	Zinc White, Prussian Blue.	Terra-Verte.
	YELLOWS.	
AMBER.	Zinc White, Golden Ochre, or White Lead, Lemon Chrome.	Cadmium (deep). Cadmium.
ANTIQUE BRASS.	White Lead, Orange, Chrome.	Vandyke Brown or Black Japan.
BRASS.	Yellow Ochre, White Lead, Orange Chrome.	Vandyke Brown.
CANARY.	White Lead and Naples Yellow.	Emerald Green (thin).
CHAMOIS.	White Lead and Middle Chrome.	Terra-Verte.
CITRON.	White Lead and Middle Chrome or White Lead, Venetian Red, Yellow Chrome.	Brown Madder Lake (thin). Prussian Blue.
DAFFODIL.	White Lead, Lemon Chrome.	Burnt Sienna.
GOLD.	White Lead, Golden Ochre, Vermilionette.	Raw Sienna.

Name of Colour.	*Ground Colour.*	*Glazing Colour.*
Old Gold.	Middle Chrome, Vermilion, Burnt Sienna, or White Lead, Oxford Ochre.	Cobalt (thin). Burnt Sienna.
Marigold.	Zinc Oxide, Naples yellow.	Cadmium (deep).
Melon.	White Lead, Lemon Chrome.	Raw Umber.
Mushroom.	Yellow Ochre, Burnt Sienna.	Raw Umber.
Maize.	White, Orange Chrome.	Cadmium (mid).
Primrose.	White Lead, Lemon Chrome, Naples Yellow.	Emerald Green.
Topaz.	White, Raw Sienna, Lemon Chrome.	Cadmium (deep).
	Greens.	
Apple Green.	White Lead, Prussian Blue, or Lemon Chrome, White, Celestial Blue.	Cadmium (mid). Lemon Chrome.
Duck-Egg Green.	Zinc White, Lemon Chrome.	Prussian Blue.
Etruscan Green.	White Lead, Prussian Blue.	Terra-Verte.
Eau de Nil.	White Lead, Lemon Chrome, Prussian Blue.	Emerald Green.
Grass Green.	White Lead, Oxford Ochre.	Cobalt.
Chartreuse.	Zinc Oxide, Lemon Chrome, Celestial Blue.	Cadmium (mid).

Name of Colour.	*Ground Colour.*	*Glazing Colour.*
Ivy Green.	White Lead, Lemon Chrome, Burnt Sienna.	Prussian Blue.
Myrtle.	Zinc Oxide and Ultramarine.	Emerald Green.
Olive.	White Lead, Lemon Chrome, Burnt Sienna.	Emerald Green.
Seaweed Green.	White Lead, Lemon Chrome, Vandyke Brown.	Indigo.
Sea Green.	White Lead, Raw Sienna.	Cobalt.
Willow Green.	White Lead, Naples Yellow.	Indigo.
	Browns.	
Bay.	Vermilion and Vandyke Brown.	Brown Madder Lake.
Chestnut.	Yellow Ochre and Middle Chrome, or Burnt Sienna and Indian Red.	Burnt Sienna. Vandyke Brown.
Chocolate.	Burnt Sienna, Vermilion, Ultramarine Blue, or Burnt Sienna, Indian Red.	Crimson Lake. Vandyke Brown.
Cinnamon.	French Ochre and Indian Red, or White Lead, Orange Chrome.	Burnt Sienna. Burnt Sienna.
Cafe au Lait.	White Lead, Lemon Chrome, Veg. Black, Orange Chrome.	Burnt Sienna.

Name of Colour.	*Ground Colours.*	*Glazing Colour.*
Cherry.	Raw Sienna, Burnt Sienna.	Raw Umber.
Leather.	French Ochre, White Lead.	Burnt Sienna or Black Japan.
Nut Brown.	Venetian Red, Lemon Chrome, White Lead.	Burnt Sienna.
Tan.	White Lead, Lemon Chrome, Burnt Sienna.	Raw Umber.
Woody Brown.	Orange Chrome, Indian Red.	Vandyke Brown.
	Greys.	
Cool Grey.	White Lead and Ivory Black.	Prussian Blue.
Dove.	White, Ivory Black, Prussian Blue.	Terra-Verte.
Fawn.	White, Raw Sienna	Raw Umber.
Heliotrope.	Zinc Oxide, Vermilionette.	Ultramarine Blue.
Lavender.	Zinc Oxide, Ultramarine and Carmine.	Cobalt.
Mouse Grey.	White Lead, Prussian Blue.	Burnt Umber.
Pearl Grey.	White, Prussian Blue, and Vermilion, or White Lead, Vermilion.	Terra-Verte. Emerald Green.
Silver Grey.	White Lead, Ivory Black.	Indigo.
Opal.	White Lead, Celestial Blue.	Burnt Sienna.

Name of Colour.	*Ground Colours.*	*Glazing Colour.*
Warm Grey.	White Lead and Venetian Red and Ivory Black.	Vandyke Brown.
Wedgwood Grey.	Zinc Oxide, Prussian Blue.	Terra-Verte.

CHAPTER XVII.

Colours made with black japan.

A large series of most useful colours can be made by mixing black japan with ordinary painter's colours of bright hue. Black japan is made of asphaltum mixed with linseed oil and sometimes gum animi and other materials, including red lead and litharge. It is not used by house painters to the extent it deserves, although it is a great favourite with carriage painters. Black japan should always be semi-transparent, and is applied on a ground of best black ground in turps. Its duty is to give additional depth to the black and counteract the greening or greying tendency of the varnish.

It is due to its transparency that it makes such an excellent stain when thinned down, and provides such nice tints or shades when mixed with other colours.

The following list gives a few of the principal colours that may be made, but any bright colour may be mixed with black japan in varying proportions to obtain useful colours. The reader who is interested in the subject should experiment in the same way as he has done with the other ordinary colours as described in the foregoing chapters. Take a bright red and add a very little black japan; then add to another small sample of red a little more black, and so on, mixing each and comparing one with the other. Next take a bright green and follow the same plan, then yellow, blue, etc. Excepting with the very light grades no great result will be obtained with

blues, in fact, ultramarine when added to black japan gives a very good solid black.

Perhaps the most useful colour that can be made from black japan is the series of colours suitable for scumbling. For example, when finishing relief material some very excellent tones may be obtained, especially if the colour is thinned with turpentine. Black japan has not much body, and if this is desired drop black should be added.

The reader is recommended to mix some of the colours named below in the way there indicated, and to use them over bright red, buff, or yellow grounds. If a coat of colour is given to such a ground and the surface is gone over with a dry brush, some novel and pleasing effects may be produced. Such effects may be produced in an even more satisfactory manner by using any of the scumble colours now used so extensively for brush graining.

Rich Dark Red.—Mix Indian red with a little black japan.

Rich Dark Brown.—Mix crimson lake and black japan, varying the amount of each according to the depth required.

Chocolate Brown.—Mix orange chrome with black japan.

Leather Colour.—This is obtained in exactly the same way as chocolate brown, excepting that rather more chrome is used.

Bottle Green.—Mix together Prussian blue, Dutch pink and black japan.

Invisible Green.—Use the same mixture as for bottle green but use less japan.

Light and Dark Reds.—A series to which there is no end, may be obtained by mixing either vermilion or vermilionette with black japan in varying proportions.

Neutral Green.—This is produced by adding lemon chrome to a little black japan.

STAIN FOR WOODWORK.—This can be obtained by using any of the foregoing colours sufficiently dark, that is with enough black japan added, but taking care to thin down according to the depth required.

NOTE.—As a rule black japan receives a final coat of varnish, but if a dull surface is required it may be obtained by giving two coats of japan and rubbing down each with felt and pumice stone, taking care to use plenty of water.

CHAPTER XVIII.

GRAINING AND MARBLE GROUNDS AND COLOURS.

These grounds should all be made up to dry a semi flat, and are best hardened off by adding a little hard drying varnish in the place of oil. This will enable the graining colour to be rubbed in more evenly and with less drag, and it will be found specially advantageous when graining in water colour or beer, as it lessens the tendency to "cissing," and saves a considerable amount of time usually spent in damping down the surface.

MAPLE.—White lead tinted with a very little vermilion and about an equal quantity of lemon chrome. Some prefer yellow ochre only, others ochre and raw umber in the proportion of four ounces ochre and one ounce umber to thirty pounds of lead.

MEDIUM OAK.—Add French ochre to white lead in the proportions of about one hundred and twenty of lead to five of ochre ; add a little burnt umber.

MAHOGANY, DARK.—Four pounds of medium Venetian red, one pound of orange chrome yellow, and one pound of burnt umber, or a little less burnt umber may be used according to the strength.

MAHOGANY, LIGHT.—Mix six pounds of pure white lead with one pound medium Venetian red and five ounces of burnt umber.

LIGHT OAK AND BIRCH.—Eighty parts of white lead to one of yellow ochre produces a good ground, but sixty pounds of white lead, half a pound of French ochre, and one ounce of lemon chrome is sometimes preferred.

DARK OAK.—Sixty parts of white lead and one part of golden ochre may be used, or the following mixture if preferred. Six pounds of white lead, one pound of French ochre, two ounces medium Venetian red and two ounces of burnt umber.

SATINWOOD.—Mix six ounces of lemon chrome to fifteen pounds of pure white lead and add a little deep English vermilion.

POLLARD OAK.—Tint one hundred pounds of white lead with twenty-seven pounds of French ochre, four pounds of burnt umber, and three and three-quarter pounds medium Venetian red, or mix Oxford ochre, Venetian red, and white lead in proportions to form a rich buff, ground together with equal parts of boiled and raw linseed oil and turpentine with the necessary driers added, or white lead, chrome yellow and vermilion will answer equally well.

PITCH PINE.—Tint sixty pounds of white lead with half pound medium Venetian red, and quarter pound of French ochre.

ITALIAN WALNUT.—One pound of French ochre mixed with ten pounds of pure white lead and four ounces of burnt umber and four ounces medium Venetian red give this ground.

AMERICAN WALNUT.—Thirty pounds pure white lead tinted with nine pounds of French ochre, four pounds burnt umber, and one pound medium Venetian red.

ANTIQUE OAK.—Thirty pounds pure white lead tinted with nine pounds of French ochre, four pounds burnt umber, and one pound medium Venetian red.

ASH.—White lead tinted with a very little vermilion and about an equal quantity of lemon chrome. Some prefer yellow ochre only, others ochre and raw umber in the proportion of four ounces ochre and one ounce umber to thirty pounds of lead.

BIRCH.—Eighty parts of white lead to one of yellow ochre produces a good ground, but sixty pounds

of white lead, one-eighth of a pound of French ochre and one ounce of lemon chrome is sometimes preferred.

KNOTTED OAK.—Sixty pounds of white lead, nine pounds of French ochre, and three and half pounds burnt umber. Same as Pollard Oak.

WAINSCOT OAK.—Mix white lead, yellow chrome and Venetian red, or white lead, chrome yellow and vermilion. Strain the colour before using.

BIRD'S EYE MAPLE.—Add a little Oxford ochre to white lead or a little Venetian red, or Vermilion will answer equally well, but only very little must be used.

BIRCH.—Add a little Oxford ochre and a little Venetian red to white lead, rather more ochre than red, to produce a very light buff colour.

ROSEWOOD AND DARK MAHOGANY.—Four pounds of medium Venetian red, one pound of orange chrome yellow, and one pound of burnt umber, or a little less burnt umber may be used according to the strength.

The examples of graining grounds given in the coloured plate with their mixtures must be taken as an average arrived at from comparison of the methods employed by different painters in various parts of the country. No doubt some readers will not agree with them, and will think that the colour should be lighter or darker as the case may be. As we have explained, the mixtures given are those which may be considered an average, and a variation of them may be made according to individual taste and judgment.

GRAINING COLOURS.

Having given the ground colours, we now proceed to give those which are used for graining. It will be understood that the method of obtaining a graining colour varies just as much as it does in the case of the ground colour, according to the opinion of the painter. The following are given as what may be safely followed to get an average good result.

LIGHT OAK.—Mix one-third burnt umber with two thirds raw sienna, and add a very little drop black.

LIGHT OAK AND BIRCH.—Burnt umber lightened with Oxford ochre is frequently used.

BIRD'S EYE MAPLE.—Mix raw umber and raw sienna with a little Vandyke brown or ivory black. Three parts Vandyke brown and one part raw sienna will give a brown tint, but this must be modified according to whether brown, yellow or grey maple is to be imitated.

ASH.—Same as light oak.

AMERICAN WALNUT.—Burnt umber to which is added a little Vandyke brown will give a good graining colour for walnut.

MAHOGANY.—Burnt umber, burnt sienna and Vandyke brown, with the addition of a little crimson lake for over graining, will answer well for mahogany.

ROSEWOOD.—Vandyke brown, with the addition of a little black, should be used, and rose pink may be added if desired.

MAHOGANY.—In producing the colour for ordinary use, such as, for instance, Anaglypta or lincrusta or other relief material, mix Venetian red with equal parts of burnt umber and burnt sienna, and even add a little orange chrome to give brightness.

POLLARD OAK.—Mix burnt umber, Vandyke, raw and burnt siennas, and add a little black or ultramarine. Same as wainscot oak, which see.

CHERRY.—Use raw and burnt siennas and raw umber.

CHESTNUT.—Mix raw sienna, Vandyke and raw umber with a very little burnt sienna.

WAINSCOT OAK.—Mix burnt and raw Turkey umber with a little megilp to prevent running. If a dark oak is required add a little black in oil or a little purple lake.

BIRCH.—Equal parts of Vandyke brown and raw sienna.

KNOTTED OAK.—Same as wainscot oak.

MARBLE GROUNDS.

These may be produced in the following manner :—

White.—A dead white ground should be used mixed to dry hard and smooth.

Sienna.—White blended with a mixture of white and raw sienna in irregular patches.

Pink Marble.—The ground may be the same as that used for sienna, but a little Venetian red should be added to give it a pinkish cast.

Alabaster.—Light cream ground made by adding a little middle chrome and vermilion to white.

Rouge Grotte.—This is a very beautiful marble which contains a large number of different colours. The ground may be either white or Venetian red, mixed with a little chrome yellow.

Granite.—There are several varieties of granite, the principal being termed "grey" and "red" respectively. To mix the former ground, add a little black and Prussian blue with just a touch of Indian red to white. The grounds for red granites can be produced by mixing Venetian red and white.

Rouge Royal.—A mixture of Indian red, Venetian red and vegetable black, with a little white, will make the correct colour for the ground of this beautiful marble. It is very necessary that the ground be quite "solid," and to produce this, two, or even three, coats may be necessary.

Egyptian Green.—The ground should be a dead black.

Verd Antique.—The same as above.

Devonshire Marble.—Venetian red and ochre with a little white to produce a light terra-cotta ground.

Black and Gold.—A dead black ground should be used.

DOVE.—In this case a white ground without gloss may be employed, but a grey is better, such as that produced by tinting white with Prussian blue, a little black and a very little Indian red.

GREY.—The same as "Dove."

ST. ANNE'S.—A dead black ground should be used.

CHAPTER XIX.

Mixing Paints and Colours on the Manufacturing Scale.

With the object of giving information to that large and increasing class of paint users who desire to have an intimate knowledge of their materials, and who wish from time to time to be in a position to manufacture on a larger or smaller scale certain of the standard grades of paint materials, this chapter is added.

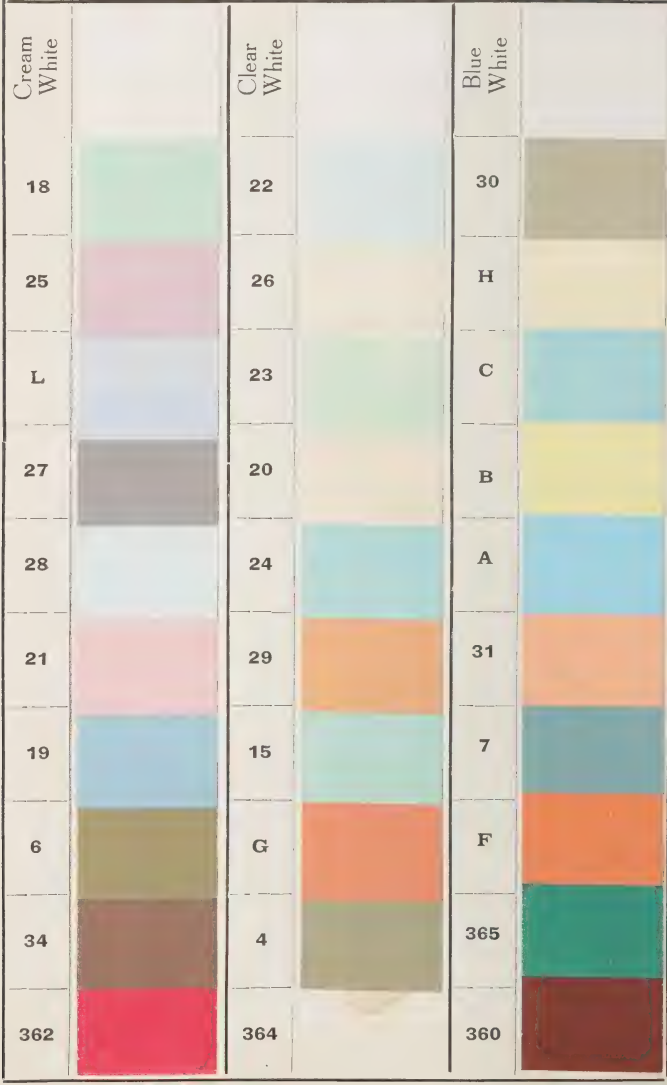
Although it cannot claim to be absolutely exhaustive (the subject being an exceedingly wide one) it will at the same time afford a certain amount of information and point out the main principles of the subject under consideration.

RAW MATERIALS USED IN PAINT GRINDING.

It must not be lost sight of that the manufacture or preparation of a finished paint ready for application on any surface takes place in a variety of stages. The first stage is the preparation of the pigment or mixture of pigments, that is the dry powder or powders which form the pigmentary base of the paint. The preparation of pigments forms an important branch of industrial chemistry and is quite outside the scope of a volume like the present. The manufacture of dry white lead, dry zinc white, the oxides of iron, carbon black, ultramarine blue, the chromes, Chinese and Prussian blue, emerald, Brunswick, Bronze and other greens, lakes, etc., form part of this wide subject

"ALABASTINE"

(WATER PAINT).



The second stage in ready mixed paint manufacture is to reduce the before mentioned pigments or powders to the paste form by grinding them in a suitable medium. In the enormous majority of cases that medium is raw linseed oil, but occasionally and for special purposes other media are employed instead of this.

This branch of the subject, that is the mixing and grinding of the dry pigments with oil to form a paste, is termed *paint grinding*, and is a branch of th industry which is carried on by most of the large manufacturing paint houses, many of whom do not themselves make the dry pigments.

The final stage is the incorporation of the stiff or paste paint with suitable vehicles or media to form ready mixed or prepared paints as used by the painter and decorator. In our present more or less restricted view of the subject we will commence with the work performed by the ordinary paint grinder, and we will in the first instance turn our attention to raw materials used in paint grinding.

These are, as we have indicated above, the base dry colours, but they also include many other materials introduced into the paint for specific purposes. One of the most important purposes is to cheapen the product and in such cases they are termed adulterants. Sometimes, however, materials are introduced into the paint not for the purpose of cheapening or adulterating the finished article, but in order to communicate to it certain specific properties which will increase its value as a decorative or protective agent. The following list includes most of the materials used in paint grinding apart from the true pigment which is the base of the particular paint which it is desired to produce, viz. :

Barytes.—A heavy white or greyish white natural mineral of crystalline texture consisting principally of sulphate of barium. This article varies in quality

and price according to its whiteness and freedom from earthy and irony matter. The finest grades are used to adulterate white lead, white zinc, and similar high class white pigments. The commoner varieties are introduced as cheapening agents into putty and coloured paints generally. It has been termed the paint grinder's friend, and it is equally his enemy according to the point of view. Its price varies from 35s. to £4 per ton, and a peculiarity of the material is that it requires a very small proportion of oil to reduce it to the consistency of paste.

Whiting or Paris White.—This well known material (which is almost pure carbonate of lime) is used largely in cheap paints to neutralise the heavy and porous nature of barytes; it is more opaque than barytes but it is much lighter and absorbs a much larger proportion of oil. It is, as is well known, the base of common distempers and a peculiarity of the article is that although in a water medium it dries out very white, in an oil medium it assumes a yellow colour. Putty is composed largely of whiting.

Gypsum or Terra Alba.—This material is not much used in Britain in paint making but enjoys a wide use in America, and for certain kinds of paint it has much to recommend it. If it is adopted care should be taken that it should only be employed in the *hydrated form*, as if it is not used in this form it rapidly absorbs moisture from the air and sets into a hard impervious mass, acting precisely as the well known plaster of Paris. Terra alba of good quality is a very white pigment and amalgamates well with certain of the lighter oxide of iron colours, ochres, etc., forming protective paints of good quality.

China Clay.—This article is never used in large quantities in paint grinding, but a small proportion is sometimes introduced into paints of a spongy or open texture in order to give coherence.

A word or two must be added with regard to the

base pigments with which the foregoing cheapeners or adulterants are mixed. Little need be said of white lead or white zinc, as to completely treat of these well known articles would cover many pages. The following brief notes, however, on the chief colour pigments may be of use, and one remark applies to them all, viz., that in manufacturing paints it is the truest economy to purchase the very best pigments that can be obtained. By *best* we mean the strongest and brightest, and these properties should in every case be carefully tested against a standard sample.

YELLOW PIGMENTS.—The ochres are natural earths, and are valued in proportion to their purity of yellow tone, staining power and freedom from materials such as chrome or cheap lakes introduced with the object of giving a fictitious yellow tone. A good quality grinding ochre will fetch a very high price and it is one of the most expensive colours to grind, requiring to be passed through the rollers many times before the grit is finally disposed of. The chromes are well known yellow pigments and are seldom ground otherwise than pure.

RED PIGMENTS.—These are obtained in endless variety, the most important being the *iron reds*, the best of which is oxide of iron. Thus we have *Indian red, Venetian red, bright oxide reds, purple browns and purple oxides* and many other oxide colours known under fancy names. In purchasing these for grinding purposes they should be examined for staining power and also for the tone of shade produced on reduction with white lead and whiting respectively. The colour produced on reduction with whiting is important for the reason that cheaper grades of paint would be produced in this way and often an unpleasing tint of red is produced on reduction. Freedom from grit is also an important feature. It is a great mistake to purchase a red which is difficult to grind even although it is otherwise cheap, as the saving in price

will be rapidly neutralised in the subsequent grinding operations. Other red pigments are the *red lakes* and so-called *fast reds* and *aniline reds*, which are used in comparatively small proportions for special decorative purposes.

Black Pigments.—The most important is perhaps ivory black and a large proportion of black sold under this name to-day is not ivory black at all but simply *bone black*, the production of ivory black being very limited. Other blacks are *vegetable or lamp black* and *gas or carbon black*. The latter possesses great staining power and is useful in giving the requisite amount of blackness to black paints which, paradoxical as it may seem, always contain a large amount of white material.

Blue Pigments used by the paint grinder are ultramarine blue, to a very limited extent, and more largely Prussian blue usually in one or other of its reduced derivatives, *Brunswick blue* (which is Prussian blue struck on a base of terra alba) or *celestial blue*, (which is composed of Prussian blue struck on a base of barytes). The enormous staining power of Prussian blue will be understood when it is said that a very excellent and strong staining Brunswick blue can be produced by striking Prussian blue on terra alba in the proportions of 12½ per cent. of Prussian blue to 87½ per cent. of white base.

Green Pigments.—The great bulk of these consist of the well known Brunswick greens which really consist of a mixture of chrome yellow, Prussian blue, and white base, the latter being usually barytes. In the case of greens it is of the utmost importance to use a very pure and strong staining colour, otherwise it is impossible to reduce them with economy in the mixing and grinding.

Having disposed of the dry colours used in the process of paint manufacture we now turn to the oil employed to reduce the dry colour to the paste or

stiff form. Linseed oil is the only oil of practical importance in this connection, although for artists' colours some other of the drying oils are occasionally used. The proportion of oil absorbed by the various pigments is a matter of great consequence to the paint grinder, and we give the following table compiled by Mr. J. Cruickshank Smith, B.Sc., F.C.S., the figures in which represent the number of parts of oil by weight usually required by 100 parts by weight of the respective dry colours.

TABLE OF QUANTITY OF LINSEED OIL REQUIRED IN GRINDING PIGMENTS.

hite Lead (English stack made)	6½—7.
„ (Chamber process)	7½—8.
Oxide of Zinc	20—21.
Sulphide Zinc White	14—16.
Sulphate of Lead (Glasgow White)	8.
Best White Barytes	7.
Second Quality Barytes	8.
Common Grade Barytes	9—10.
Paris White	21—23.
Oxide of Iron Pigments	18—24.
Fine Italian Ochre	87.
Strong Staining Ochres	50 and upwards.
Strong Staining Siennas	95 „
Fine Turkey Umbers	85 „
Vandyke Brown	95
Vegetable and Carbon Black...	95
Pure Chromes	12.
Ultramarine	33.
Lime Blue	25.
Pure Prussian Blue	100.
Brunswick Blue	16.
Celestial Blue	12
Brunswick Green	15—20.

The question of oil is all important in paint grinding as the cost of the oil is one of the most serious considerations. It is therefore one of the problems which face the paint grinder to adjust his paint mixing in such a manner as to necessitate the introduction of the smallest possible quantity of oil in the grinding

At the same time he has to consider that unless there is an adequate proportion of oil present he cannot get the paint to mix properly and therefore he has to hit upon the nappy medium. The general rule is that the heavier the pigment the less oil it absorbs, and a reference to the foregoing table will show that this rule is followed pretty closely, white lead and barytes which are the heaviest pigments, absorbing the smallest proportion of oil, while pigments like sienna and Vandyke brown, which are very light, require almost their own weight of oil. A further important point is that damp pigments always require more oil to grind them than dry pigments.

It is a mistake to suppose that the use of cheap or indifferent linseed oil cheapens the cost of the paint, because it does not do so. Oil containing a large proportion of albuminous matter does not go so far as a clear bright oil. Therefore attention ought to be paid to the quality of the oil purchased and also to the storage tanks to see that they are free from sludge and foots.

The last ingredient we have to revert to in the case of stiff paints is what is sometimes termed the "binder." This material may vary in nature and it is not always required. Its object is to enable the oil to retain the pigment in suspension. Thus, if the paint grinder is grinding a somewhat low quality of Brunswick green, he finds that after the paint is ground and placed in the kegs, the solid matter is apt to settle down with the result that the lower part of the keg contains a hard mass of pigment and the upper part a sloppy mass of mixed oil and pigment. To avoid this inconvenience which at once results in complaints he introduces into the paint in the process of mixing something of a tenacious viscous nature which helps the oil and pigment to remain incorporated together. Boiled oil is sometimes used for this purpose and some old fashioned grinders use a large proportion of

boiled oil in their paint mixing. This practice, however, is rapidly dying out and a better material to use is a small proportion of varnish foots, say 7 to 14 lbs. to the cwt., but care must be taken that the quantity is not too large, otherwise the whole of the paint will set hard in the kegs. Before finally adopting any particular batch of varnish foots or other similar material as a binder it should be tried on a small scale, as these materials often contain large quantities of active driers and other chemical matters which act in peculiar ways on the paint.

Machinery and Plant Used in Paint Grinding.

After a paint grinder has decided on the relative proportions of colour, cheapening materials, oil and binder, he has to set about amalgamating these into the stiff paint and the first process is that of mixing.

Paint mixing machines are of various types, and some of them are described and illustrated in Chapter I. They include :—

(1) The old fashioned pug mill, which consists of a vertical cylinder with revolving spindle carrying usually six knives set at right angles to this spindle which, when the latter rotates, cut through the mass of paint and gradually mix it.

(2) The vertical mixer which consists essentially of a horizontal box or chamber containing blades which revolve and cut the paint up after the fashion of a dough mixing machine used by bakers.

(3) The improved pan mill of which that perfected by Messrs. Torrence, of Bitton, may be taken as a type. This latter mill possesses many attractions and is especially useful where mixing has to be done quickly, as owing to the construction of this mill the paint undergoes a good deal of grinding as well as mixing.

The second class of mill referred to above is only useful for fairly soft paints. For very stiff paints the first class is said by some authorities to give the best results. The process of mixing paints in any of the

above mentioned machines is not altogether a haphazard process. For example, in mixing tinted paint it does not do to throw in all the white colour first and then dump the staining material in towards the end of the operation. As a matter of fact the best results are got by mixing up the tinting matter separately in another mill and introducing it in the mixed state into the mixture containing the white colour. This avoids the formation of lumps and irregular patches of material which would otherwise manifest themselves when the mixture was placed upon the grinding rollers.

In making up tinted paints on a large scale the order in which the various tinting materials are added is somewhat important, and if this be not attended to the result is frequently that a considerable proportion of material is wasted. In this connection the author strongly recommends anyone who proposes engaging in the manufacture of tinted paints to undertake a fairly exhaustive course of study of the actual tinting and staining properties of the pigments commonly used by paint grinders. This side of the question is very frequently left somewhat severely alone with the result that it is only after numerous failures and spoiled batches that the would-be manufacturer comes to appreciate the relative strengths and tinting properties of the raw materials which he 's using. A very useful course of study is to take in rotation the various staining pigments commonly used by paint grinders, most of which we have already dealt with in the foregoing paragraphs, and to reduce these in varying proportions with white lead, white zinc and whiting. In this way a very fair idea is obtained of the variety of shades obtained by these strong staining materials.

In order to indicate a few of the points that have to be attended to in making up tinted paints in general we may discuss in some detail the manufacture of

two typical tinted paints, viz. : Slate colour and mast colour paints.

We will suppose that the paint manufacturer is required to produce a slate colour paint in the stiff form, and we will imagine that the exact tint to which his paint is to conform has been given him. Let us suppose that this tint is of a somewhat pale colour of the nature of the so-called "invisible grey" used in the British Navy. Now, every practical man who has gone through a course of training in the staining properties of pigments will see by inspection of this colour that it contains four elements, viz. : white, black, blue and red, and common sense united with a little practical experience will show him that it will be fatal to the ultimate result if he adds too much black to begin with. He will know by practical trial and experience that the most sensitive or easily affected of the four elements just mentioned is blue, and he will be proceeding on correct lines if he adds the blue tinting material first. Let him therefore select his white base, which in the case of a somewhat "clean" or bright looking colour would be oxide of zinc (either pure or reduced according to the required cost with terra alba). Let him then add such a quantity of ultramarine blue as will bring the paint to the same *depth* of colour as the given sample. By then adding little by little small proportions of black the brightness of the blue will be "killed" and the slate colour or greyness will gradually manifest itself. The object of the red is to neutralise the native "coldness" of the blue and black and the addition of a very small quantity of Indian red will probably suffice to give the necessary cast of colour. The proportion of Indian red will be very small and will vary according to the colour of the ultramarine used as certain grades of ultramarine possess in themselves a distinctly reddish tone.

Suppose for the moment the paint grinder were

to begin by adding black to the white base. He would in all probability overstep the mark and would obtain a dark grey colour which would require the addition of a very large proportion of blue and probably of white as well to bring it to the required slate tone. The general rule, therefore, in adding a mixture of tinting colour to a white base to produce tinted paints, is to commence with the more sensitive and delicate ones and to add the stronger and darker ones last and in the smallest proportions.

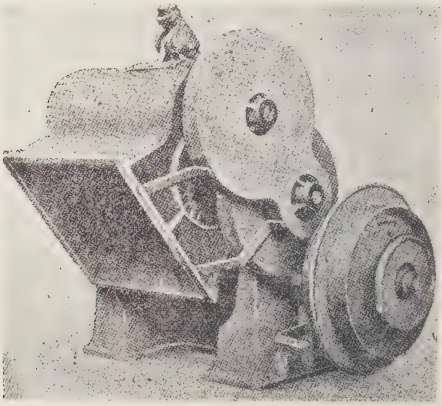


FIG. 23.

Another example of a tinted paint and the method of its production is mast colour. In this case the white base will in all probability be white lead, containing a greater or smaller proportion of whiting, and, if the quality is a somewhat low one, a proportion of second grade barytes as well. The tinting colours will be Oxford ochre, Venetian red, burnt sienna, and orange chrome. In this case the practical man will see at once that the ochre is the predominant material

and he therefore commences by adding a sufficiency of this pigment. He then adds sufficient burnt sienna to give the richness and density to the ochre ; this he then follows with Venetian red, or in the case of some low grades he would probably use Venetian red right through in place of sienna. Finally, he livens the whole up by means of orange chrome.

One of the chief points in paint grinding is to

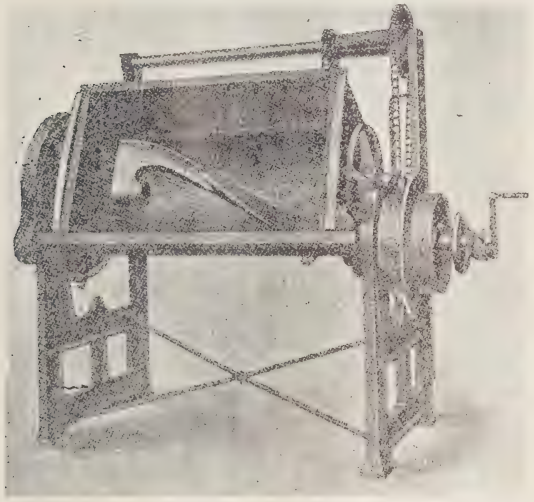


FIG. 24

judge the proportion of oil that should be added in the mixing process. Frequently the material becomes somewhat heated with the result that it works softer than it ultimately becomes when cold ; this has to be allowed for.

Another type of machine largely used for the mixing of paint bodies and the thinning down of same is the " Universal Kneading and Mixing Machines,"

made by Werner, Pfleiderer and Perkins, Ltd. These have been for very many years adopted by leading paint and enamel manufacturers. As will be seen from the illustrations, these machines consist of a trough or container equipped with one or two horizontal blades, the action being such as to produce the most thorough and perfect mixing obtainable, and in such manner as to prevent any possibility of settling or stratification. Fig. 23 shows the heavier type as used for white lead and zinc bodies, etc., whilst Fig. 24 illustrates the lighter type in use for thinning down, stirring, etc. The "Universal" type of Kneader is also extensively used in the manufacture of the finest grades of putty. These machines are, where required, supplied with arrangements for emptying through the bottom of the trough instead of by the tilting of it.

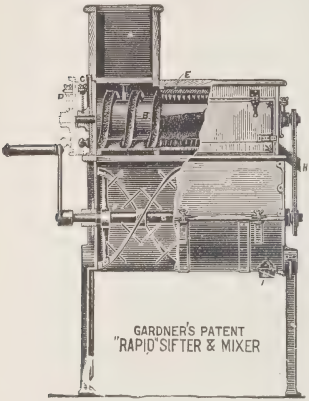


FIG. 25.

In the preparation of fine colours and paints in oil, turpentine or water, it is often most economical to mix and sieve the pigments while they are in the form of a dry powder and before they are ground in their medium. For this purpose a very useful machine is the "Rapid" Sifter and Mixer, manufactured by Messrs. Wm. Gardner and Sons (Gloucester), Ltd., and is illustrated in Fig. 25. It may be said to con-

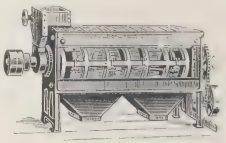


FIG. 26

sist of two chambers, one above the other. In the top chamber into which the powdered pigments are introduced is a finely meshed sieve of silk which surrounds a specially constructed spiral brush. This brush very quickly breaks up tiny lumps while the mechanism causes the finely divided powder to pass through the sieve and drop to the chamber below. At the same time any foreign matter, such as small stones, sticks and irreducible lumps, are automatically thrown out of the machine through a spout provided for the purpose. In the mixing or blending chamber below to which the finely sifted powder has descended, an agitator is provided by which the blending and mixing is very thoroughly effected in a short time. A second form of the same machine is shown in Fig. 26.

A still further variety in construction is called the "Quick Change" powder dresser. In this machine the sieve can be changed so that several powders of varying degrees of fineness can be dealt with in the same day. It can also be adjusted in such a manner that two different mixings can be produced at the same time.

After mixing, the paint is transferred to the grinding rollers which now almost invariably consist of what is known as a three-roller horizontal mill. These mills have been brought to a state of great perfection, and by the use of suitable mixing apparatus the amount of grinding is reduced to a minimum. Sometimes two, three or more grinding mills are worked in series and the paint falls from one to the other becoming still further reduced at each operation. As an indication of the difference in grinding required by different pigments we may remark that white lead is usually considered to require one grinding, white zinc two grindings, ochre staining colours three grindings, sienna and some of the harder staining colours, as well as colours for coachmakers and printers inks four to six grindings.

In the first part of this book are given illustrations and descriptions of the paint mixing machines which are suitable for the use of house painters, coach painters and decorators. It will be useful now to include a brief description of some of the larger machines suitable for the use of paint and colour manufacturers.

THE "N.T." MILL.

The "N.T." Mill, Fig. 27, is an entirely new type of edge runner mill, designed upon scientific principles, which give the maximum amount of grinding with perfect mixing or blending efficiency.

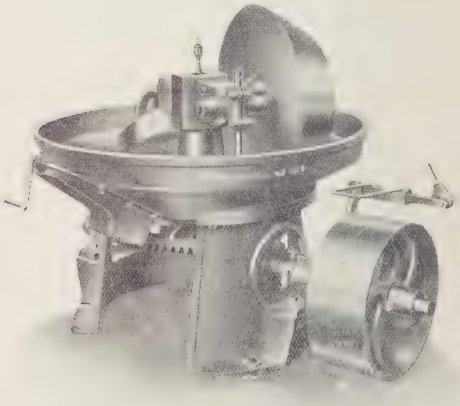


FIG. 27.—THE N.T. MILL.

It differs from other types in the formation of its roll and pan.

In the ordinary type of mill, having a flat-bottomed pan and parallel roll, a good deal of the efficiency is sacrificed by reason of the rolls running on a bed of material which, pressed into a cake by the flat face of the roll, prevents the full grinding action necessary to quickly

produce a finely-graded result; for the coarser particles are cushioned in the cake of finer material and are protected from the crushing or grinding action of the roll. In order to get the desired smoothness of finish, a good deal of extra time is necessary for the charge to be in the mill before it is fully graded or ground to a consistent fineness or smoothness of finish.

In this new type of mill this disadvantage is overcome by the great differential grinding action caused by the conical shape of the roll in its reversed position in the pan.

The pan has a sloping bottom, and the roll is of conical shape, to accurately fit the face of the pan upon which it runs.

The surfaces of the pan and roll are turned perfectly true and polished, and carefully fitted "Doctors" turn and guide the contents of the pan to the contacting points of the pan and roll, at the same time intimately mixing and blending them together.

It will be noticed that the larger side of the roll is nearest to the centre of pan, which is the principal feature of the mill; for this arrangement gives a considerable amount of differential speed between the surfaces of pan and roll, which, in effect, grinds and rubs down to

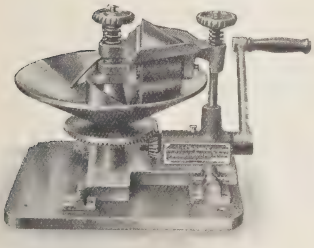


FIG. 28. LABORATORY MILL. FIG. 29. TIP UP TO DISCHARGE.

fineness in *one quarter* the time required by the old type of mill.

The mixing qualities of the mill are so perfect that, if any small proportion of colour be added to a charge already in the mill, the whole is blended and intimately mixed in a few seconds.

The mill automatically discharges its contents when the door is opened by the handle and screw fittings shewn.

This illustration shows the "Silent Quadrant" triple roller mill, 30in. x 15in. It is electrically driven,

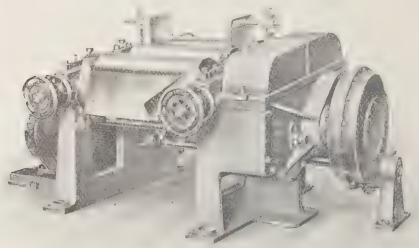


FIG. 30. THE "SILENT QUADRANT" Mill.

with all gears machine-cut, enclosed and working in an oil-bath. Manufactured by Messrs. Torrance & Sons, Ltd., of Bitton, Nr. Bristol.

The illustration in Fig. 32 shows what is known as the "Vortex" mixer, which has a capacity of 40 to 50 gallons, and is suitable for mixing and diluting all kinds of paints and enamels. The contents can be drawn off while the mixture is working, ensuring uniform consistency from first to last. The propeller blades are all polished and are in knife edged contact with the bottom of the container. They are driven by machine cut gear and work in an oil bath gear case.

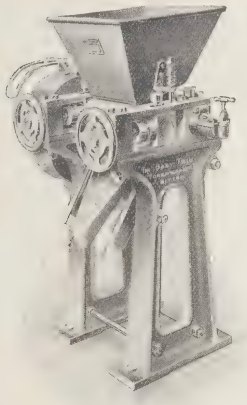


FIG. 31.—THE BABY TWIN.

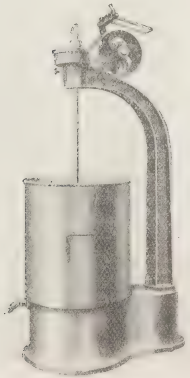


FIG 32. THE "VORTEX" MIXER.

An excellent type of mixing machine adapted for mixing dry colours in oil as well as for thinning down thick pastes to liquid paints, indeed, for nearly all kinds of mixing when uniform results are required, is the "Torrance" Patent Mixer, which has two sets of blades in the revolving pan. By means of the lever the pan is thrown out of gear, whilst the blades continue to revolve and agitate the contents, which can then be drawn off during agitation, ensuring a perfect uniform consistency from first to last. The capacity of this mixer is 30 gallons, and it is a very serviceable machine.

THE "PERFECT" MIXER.

For mixing dry colours in oil, and thinning down thick pastes to liquid paints.

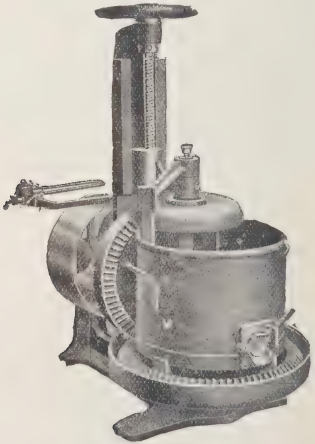


FIG. 33.—THE "PERFECT" MIXER.

The illustration shows the extreme simplicity of this machine. The whole contents of the container are in turn brought under the action of the revolving blades, and mixing is accomplished in a few minutes. The

container may be removed to any convenient place for drawing off contents. Extra interchangeable containers can be supplied, and are very useful and time saving when different colours require treatment.

The machine is self-contained. The container is 21 inches in diameter by 14 inches deep, and will mix 12 gallons at once. It is fitted with handles convenient for lifting, and discharge valve. Both are made by Messrs Torrance and Sons, Ltd., Bitton, Bristol.

This illustration shows the "Handy" Mixer which is a most convenient form of mixer for quickly reducing or thinning thick pastes and other ingredients to liquid paints or enamels ready for the brush, or for mixing dry colours with oil prior to their being ground and

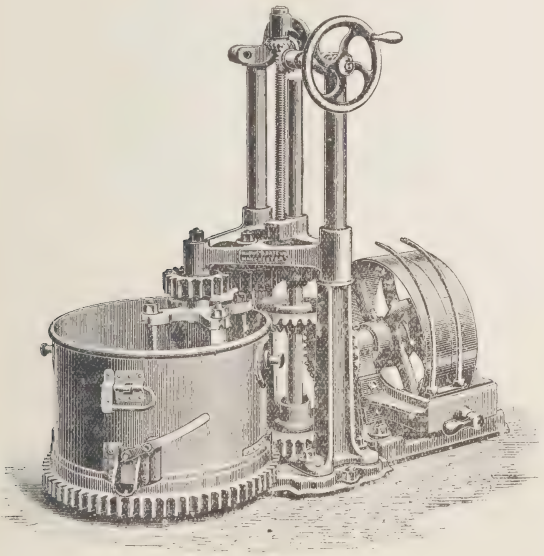


FIG. 34.—THE HANDY MIXER.

finished in the well-known and indispensable cone mill. Owing to its general handiness it is often put down in gangs where a large business is done in canned paints, but for smaller requirements—since the introduction of the electric motor—single machines are mounted on base plates with motor and all necessary starting gear attached. The beaters inside the steel pan are detachable, and rotate in the opposite direction to the pan itself, and the novel and effective addition of a baffler breaks up the whirl of the materials when agitated, thus effecting a perfect amalgamation and entirely dispensing with the necessity of two revolving beaters which are now altogether discarded, thus increasing the capacity of the pan and reducing the trouble of cleaning. The raising and lowering of the beaters is quickly performed by means of a double-threaded machine-cut screw, actuated by bevel gearing and hand-wheel.

Manufactured by Messrs. Follows and Bate, Ltd., Engineers, Gorton, Manchester.

During the last few years a new type of machine has been introduced into the paint, enamel, varnish and kindred industries. These machines operate by centrifugal, dispersing and filtering action.

One of these designated No. 11, patent disperser, purifier and separator, is shewn in the annexed block, figure 35, and is manufactured by Lang, London, Ltd., 34, Gray's Inn Road, London, W.C.1.

This machine has been specially designed and built for dealing with enamel, paint, varnish, oil, French polish and other shellac solutions, etc. The machine has for its size and price a bowl or drum of large diameter, which revolving at a great speed gives a high centrifugal force and therefore great dispersing and mixing actions, and is particularly valuable for " struck " colours. Materials having a large percentage of impurities to be ejected are profitably treated with this machine, owing to the large residue containing capacity of the bowl.

It will be interesting to give the capacity of this machine in which the in-and-out-flow is continuous. It treats about 25 gallons of the average oil enamel per hour. Cellulose enamel about 30 gallons. Spirit varnish up to 35 gallons per hour.

Apart from the centrifugal bowl, this machine is now supplied with a strainer bowl, by means of which the light impurities can be removed. The straining material used depends upon the substance to be treated. Some-

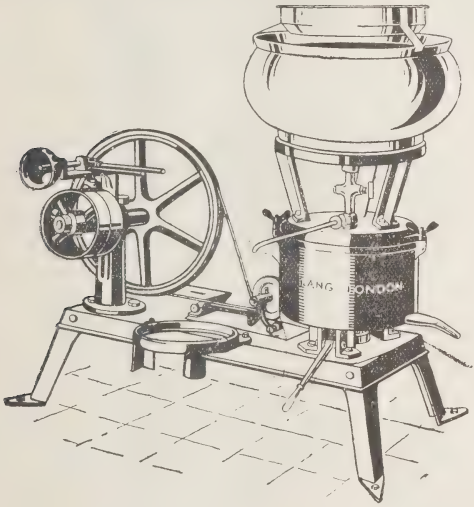


FIG. 35.

times 200 or even 300 mesh bronze wire gauze is employed and in certain cases, the closest woven cotton filtering cloth.

Small quantities of material of about 3 gallons can be treated by this machine. If extra tanks and bowls are ordered, a change over from one colour to another can take place in two minutes.

THE IMPROVED AMALGAMATOR.

This is used for Ready Mixed Paints, Oil Blending, etc. It is fitted with steel pan with double rivetted lap

FIG. 36. THE IMPROVED AMALGAMATOR.

jointed vertical seam, single rivetted to strong cast iron top and bottom rings, heavy vertical steel shaft, carrying

specially designed forged steel beaters or mixing blades, the angle of which can be altered at discretion to suit thick or thin materials. Cast-iron tap, either bib or straight bore pattern, or Discharge Door; complete with fast and loose pulleys, as illustrated. It is made by Messrs. Follows and Bate, Ltd., engineers, of Gorton, Manchester.

"Powerful" Horizontal Mixer.

This machine is constructed for rapidly and thoroughly mixing thick pastes, powder, liquids, and semi-liquids, and is useful for a variety of work, being specially suitable when the material to be operated upon is not of too dense a character, or of too great a specific gravity.

The "Powerful" Mixer effects the objects to be attained both expeditiously and well, securing the blending of dry colours or powders to uniformity, or, by the addition of liquids, the mixing is done so thoroughly that every grain of powder, however minute, is made to absorb its share of moisture and produce a liquid, semi-liquid, or paste-like dough or putty.

This machine is made in many sizes, for large or small requirements, and it is of simple construction and powerfully built. The open pan or hopper is constructed of steel, copper or brass; it swings between two heavy standards, and is locked firmly or released instantly by the withdrawal of a stop catch. The gearing which drives the horizontal beaters is neatly covered in, being protected from dirt and the possibility of accidents. The beaters, which are of peculiar shape, and made of toughened steel, are quickly detachable for cleaning, and rotate in opposite directions, in such a manner as to prevent the contents of the hopper from gathering in a mass during the process of mixing. The operation is therefore not only thoroughly performed, but the material can be instantly ejected by drawing the catch; if thick in consistency, the hopper may be allowed to swing completely over and discharge into a vessel placed beneath; if thin, the Hopper is slowly tilted

until the liquid is discharged through the spout provided in either case the beaters may be kept going, as they assist the discharge and prevent sediment from gathering, should the materials have that tendency.

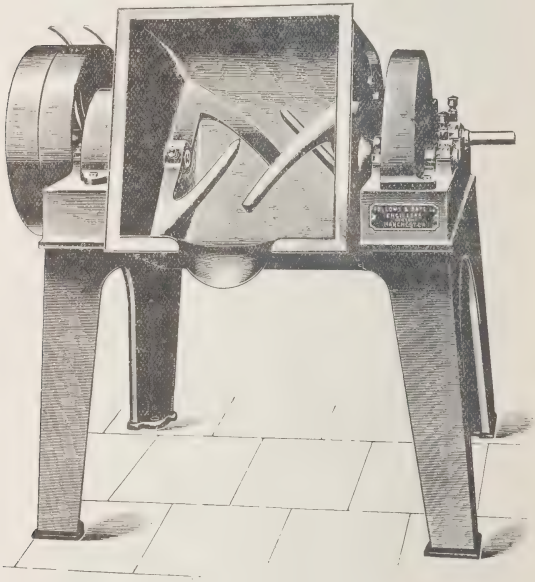


Fig. 37. The "Powerful" Horizontal Mixer.

This mixer is also made by Messrs. Follows and Bate, Ltd., Gorton, Manchester.

New Era Liquid Paint Thinning Mixer.

The New Era. This is a new thinning machine which is specially constructed for thinning out rapidly large quantities of enamel, ready mixed paints, varnish paints, etc. Its specially provided drive beater runs at a high speed and in conjunction with the fixed baffle plate, on the inside of the pan, effects the thorough mixing of the paste

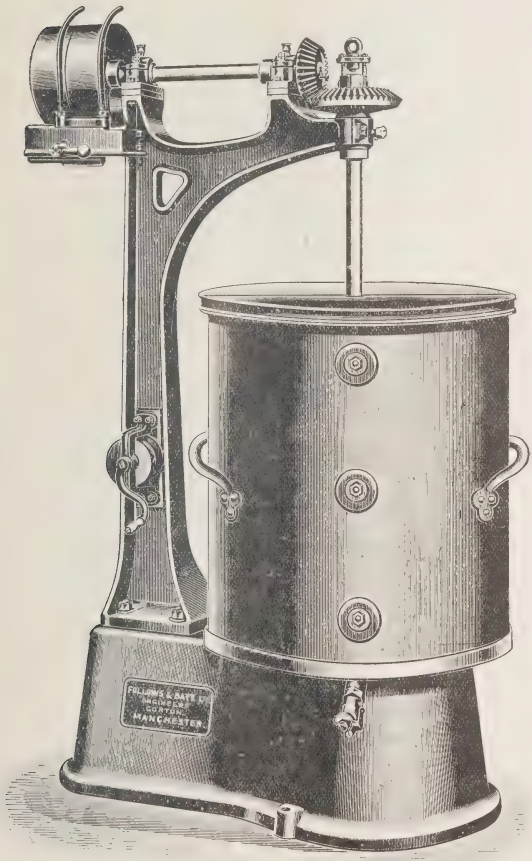


Fig. 38. THE "NEW ERA" LIQUID PAINT THINNING MIXER.

or powder with the thinning material. The beaters may be readily withdrawn from the pan for cleaning purposes. The discharge table is of the dripless type, the cover to the pan is detachable and is made in halves to prevent splashing, and to keep contents free from dust. This mixer is made by Messrs. Follows and Bate, Ltd., Gorton, Manchester.

This illustration represents a double machine, nor machine with two containers. Each set of stirrers can

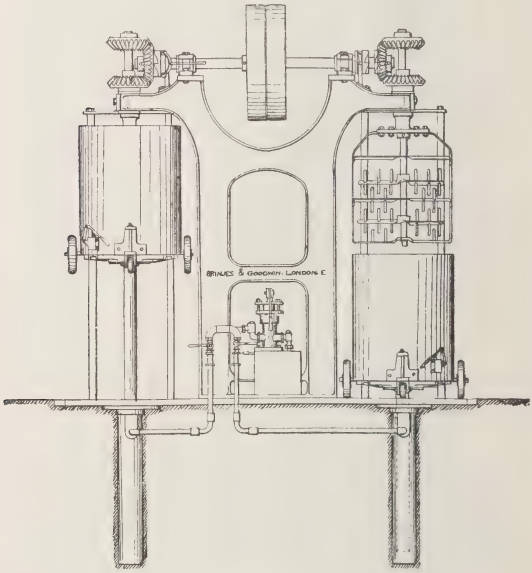


FIG. 39.—SPECIAL MIXER FOR READY MIXED PAINTS.

be worked independently by clutch bevel pinions. Manufactured by Brinjes and Goodwin, Cold Harbour, Poplar, London, E.

Fig. 40 shows Gardner's Patent Combined "Rapid" Sifter and Mixer, gear-driven type. This class of machine is fitted up with gearing in addition to the fast and loose pulleys. This proves to be a convenient mode of driving,

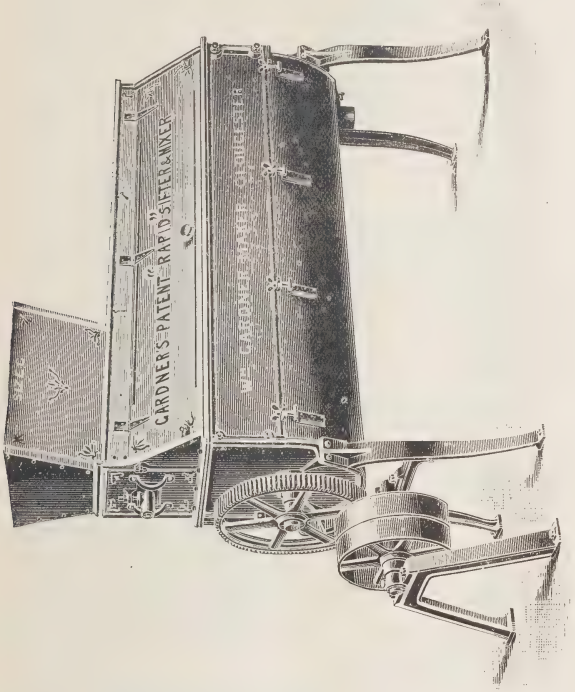


FIG. 40. THE "RAPID" SIFTER MIXER.

as, by the adoption of gearing, the machine can be started up to work with full load on, and the power taken to drive is less than required for other machines of equal size. Manufactured by Wm. Gardner & Son (Gloucester), Ltd., Patentees and Engineers, Gloucester.

Fig. 41. This machine is specially designed for decorators, engineers, paint manufacturers and dealers. The illustrations represent a most convenient and efficient form of paint mixer: for decorators it possesses peculiar advantages, as it is easily removed from place to place; it will be found equally serviceable in mixing dry colours

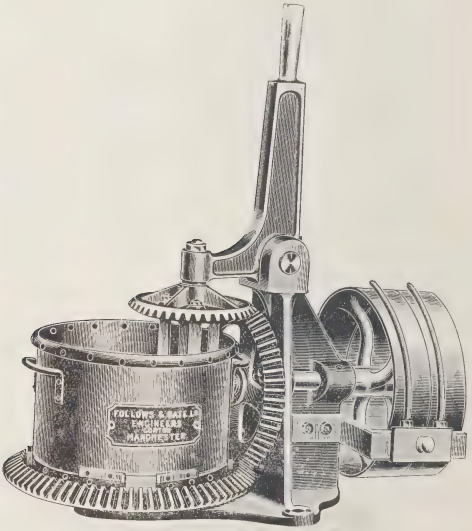


FIG. 41.—THE BENCH PAINT MIXER.

with oil, etc., as well as for thinning down paste paints and quickly obtaining any tint that may be required. The mixing pans are fitted with lifting handles and easily detached either for emptying, cleaning, or change of colours. Manufactured by Messrs. Follows & Bate, Engineers, Gorton, Manchester.

This horizontal mixer, fitted with steam jacket, which may also be used in certain cases for water cooling,

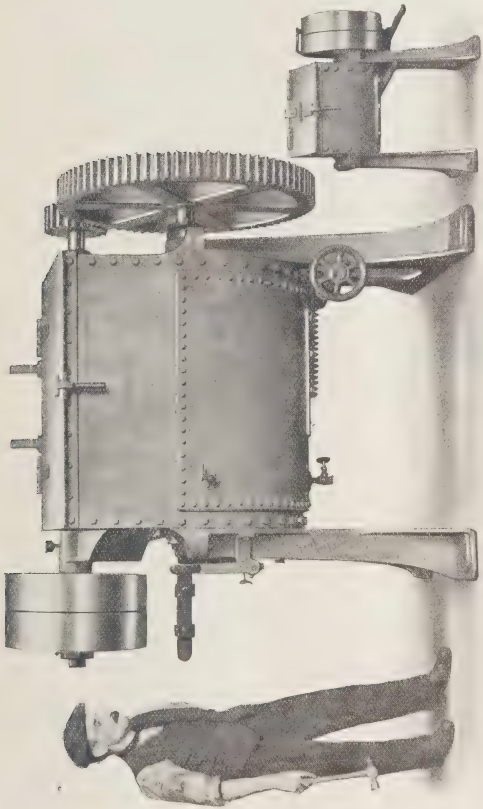


FIG. 42.—JACKETTED MIXER.

is manufactured by Messrs. Brinjes and Goodwin, Ltd., of Cold Harbour, Poplar, London, E.14.

For more minute information of the grinding of paints we refer the reader to the "Manufacture of Paint," by J. Cruickshank Smith, B.Sc., F.C.S., published by Scott, Greenwood and Son, Broadway, Ludgate, London, E.C.

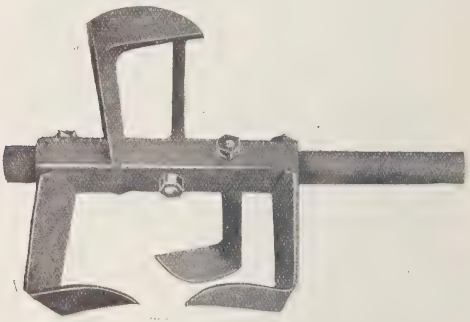


FIG. 43.—VIEW OF SPINDLE WITH KNIVES FITTED.

PREPARED PAINTS.

These are, as we have already indicated, the final stage in the manufacture of paint. The stiff paint prepared as already described is placed in large mixers either of a horizontal or vertical type where the proper proportions of oil, turpentine, driers and sometimes varnish are added. The machinery is set in motion and the mixture is thoroughly beaten up by means of stirrers for several hours, at the end of which time the ingredients have become thoroughly amalgamated. Anyone who has seen a paint mixing mill of this description will at once disabuse himself of any idea he may have possessed that a painter working with a domestic pail and a wooden paddle is equipped with an ideal paint mixing plant. The proportions of the various ingredients employed by manufacturers of prepared paints vary greatly. Much depends upon the con-

sistency of the stiff paint used, the softer this is the more easily it is worked up, and many of the ready mixed paint manufacturers are very skilful in making up their stiff paint so as to require the minimum amount of thinning with oil and turps, which are expensive ingredients. Then again the quality of the stiff paint has considerable influence ; the better the quality the more thinning material the paint will stand. Obviously, if the paint is of very inferior quality the addition of the normal quantity of liquid thinners would render the paint practically useless as a covering material. While, therefore, the dominating agent is the nature of the pigment in the stiff paint it is only practical trial with the particular stiff paint that is to be employed, which will indicate exactly how much thinners is required. As to the relative proportion of oil and turpentine, this also is a matter which will vary according to the necessities of the case. For ordinary outside use one part of turpentine to three parts of oil is ample, and the probability is that when turps reaches a high price this proportion will be reduced, if possible. The question has sometimes been discussed whether really glossy paint can be made without the addition of varnish. Trial has proved that this can be done by using a good bodied boiled oil in place of a proportion of the linseed oil. Indeed the introduction of varnish into prepared paint has little effect upon the gloss, although it has a considerable influence on the wear and vitality of the paint.

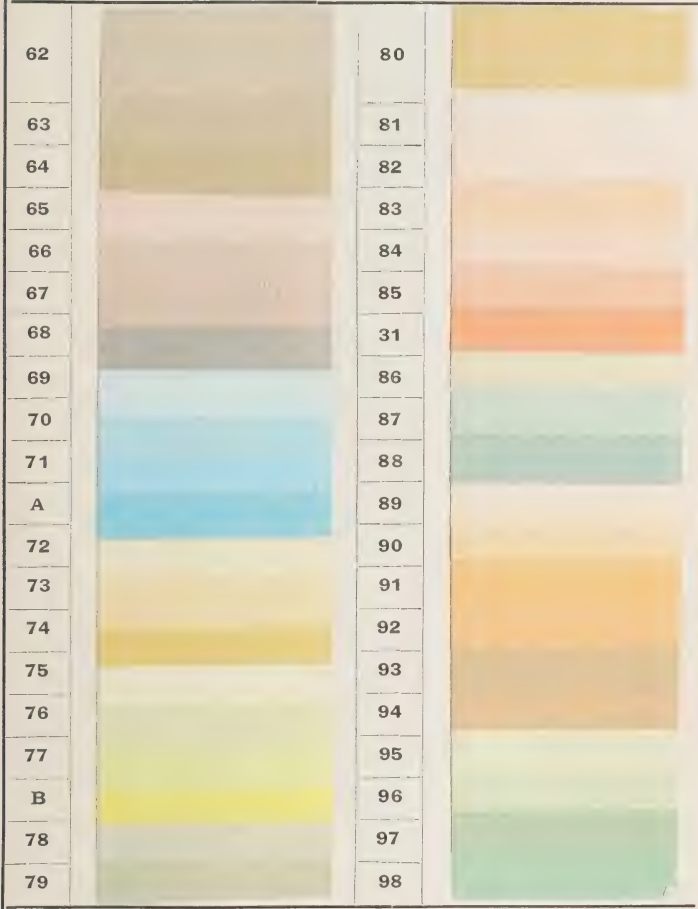
The whole question of the advisability of employing varnish as an ingredient of ready mixed paints is one on which contrary views are entertained, and if the question is asked whether or not varnish is a satisfactory ingredient of these products, the answer is that it all depends upon the nature of the varnish and the composition of the paint. Assuming that the paint is made of the very best materials, carefully

selected and prepared in the best possible manner, and assuming also that the varnish is selected with due regard to its composition and the composition of the ingredients with which it will be combined, then there can be no doubt that the introduction of a material containing, as varnish does, a proportion of gum resin will add materially to the life and protective qualities of the paint. On the other hand, if paint is manufactured to meet competition and if the temporary appearance of the painted surface rather than the composition of the paint itself has been the object of the paint manufacturer's attention; if, further, the composition of the varnish is a more or less unknown quantity, then it may unhesitatingly be said that varnish will do little good to the finished paint and may in many cases be a source of serious trouble. A varnish which is used in mixed paints must be of a special make. Not only so, but many of the cheaper gums used as substitutes for the finer copals are not suited for amalgamation with pigments. Again, the presence of certain dry materials in paint often exercises very curious results on materials of a varnish nature, causing what is known as "jellying" and other disastrous results. There is no more technical or intricate branch of varnish manufacture than the preparation of what are known as mixing varnishes, that is to say, varnishes suitable for admixture with paints and pigments, and unless the paint manufacturer is prepared to spend some time in the selection of suitable varnishes he will be well advised to leave them out of the question altogether in the fabrication of prepared paints for decorators' use. Of course, in such articles as varnish paints, anti-fouling compositions, etc., varnish of some kind is the base of the whole thing.

The recent boom in turpentine substitutes has raised the question whether these could be safely used in ordinary prepared paint. The balance of

"ALABASTINE"

Tints from Primary Colours A. B. 31. & White.



The above are lightly Stippled.

The Rule for obtaining these shades will be found within.

evidence at the present time appears to show that assuming due care and caution have been exercised in the purchase of a turpentine substitute, very good paints can be prepared containing these articles, provided there is plenty of oil in the paint as well; that is to say that while a very good glossy paint can be produced containing a turpentine substitute, it would not be so easy to produce a thoroughly good flat paint.

The question of driers in ready mixed paint also deserves attention. Paint manufacturers as a rule use nothing but paste driers, and these are usually added in a considerable quantity for two reasons.

(1) Because the driers employed are usually very cheap and tend to cheapen the paint.

(2) Because of all the complaints to which the paint manufacturer is exposed that of bad drying in paint is most troublesome, and so long as he gets his paint to dry he is not so particular about other features.

Of late years manufacturers of prepared paints for special purposes, in particular protective paints, have been adopting the principle of using liquid driers, but detailed information concerning their use and proportions is hardly within the scope of this work.

The following are authenticated proportions which have been employed in Britain in the manufacture of prepared paints. The qualities, it will be observed, are by no means first rate, but represent very fairly what may be described as ordinary commercial qualities of tinned paints suitable for re-sale. It is, of course, in the power of the manufacturer to vary these mixings according to his actual requirements.

GROUND PURPLE BROWN (FOR R.M. PAINT).

cwts.	qrs.	lbs.	
	2	0	Dry Purple Brown.
	2	0	Paris White.
2	2	0	No. 2 Barytes.
		21	Boiled Oil Foots.
		7	Varnish Foots.
		20	Raw Linseed Oil.

GROUND BRUNSWICK GREEN (FOR R.M. PAINT).

cwts.	qrs.	lbs.	
	1	21	Dry Green (pure).
	3	21	Paris White.
3	2	0	No. 2 Barytes.
		14	Boiled Oil Foots.
		14	Varnish Foots.
	1	21	Raw Linseed Oil.

GROUND WHITE LEAD (FOR R.M. PAINT).

cwts.	qrs.	lbs.	
4	0	0	Dry White Lead.
6	0	0	Best Barytes.
	2	16	Refined Linseed Oil.

COMPOSITION OF ONE TON OF R.M. PAINT ON THE BASIS OF A VARIETY OF SHADES.

cwts.	qrs.	lbs.	
14	1	15	Stiff Paint.
2	2	22	Paste Driers.
2	1	0	Raw Linseed Oil.
	2	19	American Turpentine.
—	—	—	
20	0	0	
—	—	—	

With regard to the cost of prepared paint per ton, the following is a skeleton cost sheet, including the various items which must be included in such a statement.

Cost of R.M. Paint Per Ton.

	£	s.	d.
Materials as above	0	0	0
Cost of manufacture of stiff paint	0	0	0
,, ,, of R.M. paint, including filling and labelling ..	0	0	0
,, tins	0	0	0
,, labels	0	0	0
,, packing	0	0	0
,, supervision, office, travelling, and other expenses	0	0	0

It will of course be borne in mind that the cost of tins is a very important item in the above. Tins are usually quoted at so much per gross, therefore in the case of paint packed in one pound tins there will be 2240 tins per ton, in the case of paint packed in two pound tins 1120, and so on, according to the size of the various packages. It has been stated by a prominent ready mixed paint manufacturer that he considers the cost of manufacturing ready mixed paints exclusive of materials and packages, but including labour and packing, at about £8 per ton on an average of all sizes of packages.

CHAPTER XX.

Putty, Hard Stopping, Knife and Brush Filling

It is important that the right materials be used for puttying, stopping and facing-up the work, and that these should be mixed in the correct proportions to suit the job in hand.

Especially is this the case when the number of coats of paint to be applied to any particular surface is reduced to a minimum.

One can easily imagine the result of using a soft, slow drying putty for making good on old hard surfaces which have to be finished with a touch-up and one coat. In a very short time the paint will sink in wherever the putty has been used, and present quite a different appearance to the rest of the surface.

Putty, hard-stopping and filling-up material generally should be made up at all times to coincide as nearly as possible in colour, hardness of texture and degree of porosity, to the surface to which it is applied.

It would be courting disaster to apply a very hard stopping on to a soft undercoating, and in the same way it would be useless to expect a soft putty to form a suitable foundation for the reception of a hard drying top coating.

The use of an oil putty on work which had to be followed up quickly has spoiled many an otherwise good flatting job, by sweating out into shiny patches.

The use of an inferior oil putty often causes discolouration and peeling.

There are probably as many varieties of putty and stoppings as there are of coatings which precede and follow them. A putty which is intended for sand-papering is quite a different composition to one which has to be rubbed down with pumice stone and water.

We can see how important it is that the student should have a clear idea of the composition and characteristics of the various stoppings in general use, and understand the method of production for specific purposes.

Composition of Putty.

Ordinary putty is, or should be, composed of genuine linseed oil and whiting. An average mixture consists of 5½ parts by weight of whiting to 1 part by weight of linseed oil.

Putty is made on a manufacturing scale in large quantities in an edge-runner mill, but small batches may be made by hand. After making it should be set aside to mature and again beaten up before use.

The whiting should be a fine clean quality, perfectly dry and well sifted before the oil is added. It is used in this condition principally for the glazing of wood sashes, and probably could not be superseded for this purpose.

For the many other uses in the painting business it is too slow in hardening to be used alone, and various mixtures have to be resorted to, many of which we give below.

Putty for Glazing Iron Sashes.

Linseed oil putty, bodied up with dry red lead to a consistency as stiff as it can conveniently be used.

Stopping up on the Priming.

Linseed oil putty, 3 lbs.; tub white lead, 1 lb. Bodied to an easy consistency with dry sifted whiting

Facing up on Second Colour.

Tub white lead stiffened with whiting. When a second colour other than white has been used, this facing-up stuff may be also coloured by the addition of suitable dry colours in place of the whiting.

Paste for Knife Filling-up.

To rub down with sandpaper. Make a smooth paste of dry sifted whiting and equal parts of Japan gold size, linseed oil and turpentine. To each lb. of paste add 1 lb. of tub white lead.

This is intended for filling or facing-up with the broad knife on walls or woodwork which have been previously painted.

Paste for Knife Filling-Up.

To rub down with pumice stone and water. Tub white lead, 3 lbs.; slate "filling" powder, 1 lb. (Harland's or Manders, etc.).

Make these into an easy paste with the following mixture:—Japan gold size, 3 parts; hard drying varnish, 2 parts; turpentine, 1 part.

For a *brush* filling intended to be rubbed down with pumice stone and water, the above paste should be thinned with turpentine to a heavy brush consistency.

Another knife filler, to be rubbed down with pumice stone and water:—10 lbs. linseed oil putty; 10 lbs. dry white lead; ½ lb. fine pumice powder.

Bring to a workable consistency with a mixture of Japan gold size, 3 parts; hard drying varnish, 2 parts; turpentine, 1 part.

Quick stopping. To follow up in an hour or so. Make a stiff paste of dry white lead and Japan gold size. A few spots of turpentine will make it still quicker setting, but will add somewhat to its porosity.

For stopping and facing-up direct on old paint. Equal parts of tub white lead and dry white lead, thinned with equal parts Japan gold size and hard varnish.

Distemper filling. For broad knife work. Strong jellied distemper bodied with sifted whiting. To each 3 lbs. of above add a gill of hard drying varnish. Palette well together and apply the same as a lead paste filler. Can be sandpapered when dry.

NOTE.—Many of the well-known water paints make excellent filling-up material for use with the broad knife on woodwork and wall surfaces.

The addition of some sifted whiting not only brings them to the proper consistency, but it renders them easy to rub down with sandpaper.

They have the additional advantage of being ready to use, and possess very little suction.

Alabastine possesses many advantages for the purpose named.

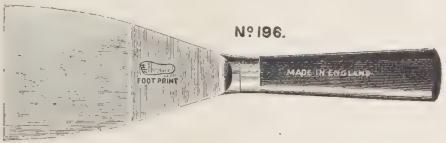


FIG. 42.

FIG. 43.

In Fig. 42 is shown one form of a stopping knife. As the width of the knife which is most useful will depend upon the kind of work in hand, it is convenient to have several widths at hand. In Fig. 43 is shown several blades on a ring. A single handle does for them all.

CHAPTER XXI.

Water Paints, Distempers, Etc.

For many years distemper colours have been used by painters with more or less success, a large variety of colours being available for interior decoration. In most cases such distemper colours consist of whiting mixed with colour in the proper proportion to produce the desired tint, size being added by the painter to bind the particles together and prevent the colour rubbing off when the hand or clothes are brought in contact with it. At the present time various washable water paints are available in a large variety of colours and have gained very considerably in popularity. Not only are they suitable for inside work, but in certain cases they can be employed also on the exterior of buildings. Further than this, some of the water paints may be painted or varnished over so as to produce the effect of oil paint at a considerable reduction in price. The varnish may be applied directly to the distemper or a coat of size may be given first. In the latter case there will be little or no darkening of the colour when the varnish is applied.

A better method than using size is to give a coat of gold size thinned with twice its bulk of turpentine. This costs rather more than the size, but is more satisfactory.

Some of these washable distempers shown on the Plates have a world wide reputation. The author feels that he should limit himself here to a description of the use of these water paints, leaving the reader to investigate further as to their respective merits. One point, however, is worth especial note, and that is each manufacturer issues a book of colours or tints which he keeps in stock, and these are freely supplied to painters on request. A small selection of such books will be found of the utmost use in selecting the particular colour required for any job, whether it be a simple cottage or a town hall. Indeed, such books are exceedingly useful to show to one's customer, who can quickly make a selection from them. The latest plan is to supply the books with the samples divided through the centre so that harmonious contrasting colours can be selected.

It is very important to note that a proper combination of colours cannot be safely obtained from small specimens of colour. The best way is to select those colours which appear to be most desirable and to paint these out on large sheets of paper and to pin these to the walls side by side in the actual position they are to occupy. A decision can then be easily arrived at.

The use of water paints may be divided conveniently into three parts, (1) for interior decorations; (2) as a substitute for oil paints; and (3) to prevent blistering. We may take these three headings *seriatim*. For inferior work they produce, if properly applied, very beautiful flat surfaces of light or bright colours as may be desired. After a little practice they are not at all difficult to apply, so as to get a flat surface without laps.

Very charming results are obtained by using a different coloured frieze to that of filling and stencilling on a simple ornament. The mistake that many painters

make is to suppose that this class of paint possesses more body than it has, or to put it in another way, because these paints have an excellent body, some painters try to produce with one coat the results that can only be reasonably expected with two. Whiting is not always the base of these paints, frequently litho-pone or zinc white is employed, it being well known that zinc white acts well either in water or oil.

As to how far these paints will go, Mr. J. Cruick-shank Smith gives the following figures:—For one hundredweight, one coat, 400 yards; two coats, 200 yards, and three coats, 120 yards. One of the most used water paints on the market is mixed with a special liquid supplied by the manufacturer, and the painter should be cautioned against making his mixture too thin, and also against adding anything (such as water), other than the ingredients recommended by the manufacturers. In every case explicit directions are given by the makers as to the use of these paints, and the painter has only himself to blame if he departs from them. The following practical recipes for distempers and water paints are by Mr. W. G. Scott, the eminent American writer on paints and painting:—

Wall Suction Size.

(*a*) 2 lb. white glue; soak four hours in $\frac{3}{4}$ gallon cold water; dissolve on water bath.

(*b*) $\frac{1}{4}$ lb. pulv. alum; dissolve in $\frac{1}{4}$ gallon boiling water.

(*c*) $\frac{1}{2}$ lb. bar soap (shaved fine); dissolve in $\frac{1}{2}$ gallon boiling water.

Into solution (*a*) pour 2 gallons of boiling water, add solution (*b*), then (*c*); stir well, then add 8 lb. of plaster of Paris. This will stop suction on the coarsest sand wall, and the surface eventually becomes as hard as flint.

Size for Distemper.

(*a*) 1¼ lb. soda (carbonate of soda) ; ¼ lb. borax ; dissolve in 3 gallons boiling water ; add a little at a time, 5lb. pulv. resin ; continue the heat until the resin is dissolved.

(*b*) 5 lb. white glue ; soak four hours in 5 gallons cold water ; dissolve and add 10 gallons hot water.

Mix (*a*) with (*b*).

Insoluble Wall Finish for Plaster Walls.

(*a*) 4 oz. chloride of zinc ; dissolve in ¾ gallon hot water.

(*b*) 2 oz. borax ; dissolve in 4 fl. oz. hot water.

(*c*) 2 oz. cream of tartar ; 8 oz. common starch ; 16 oz. zinc oxide ; mix with ¼ gallon cold water.

Mix (*a*) and (*b*), boil and add (*c*), stirring a few minutes, then apply hot.

Dextrine Binder for Water Colours.

(*a*) 8 oz. yellow dextrine ; dissolve in 16 fl. oz. cold water.

(*b*) 10 grains thymol ; dissolve in 8 fl. oz. hot water.

Mix (*a*) and (*b*).

Starch Binder.

(*a*) 3 oz. common starch beat up with 6 fl. oz. cold water, then pour into 64 fl. oz. boiling water.

(*b*) 2 oz. gum arabic ; 4 oz. pulv. borax ; dissolve in 16 fl. oz. cold water.

Mix (*a*) with (*b*).

DISTEMPER AND WHITEWASH.

Common Distemper.

(*a*) ½ lb. white glue, soak four hours in ⅛ gallon cold water ; dissolve on a water bath.

(*b*) 16 lb. dry Paris white or whiting, beat up in 1 gallon boiling water.

Pour (*a*) into (*b*), and mix by stirring.

The above formula will make about 2 gallons of distemper, and it will weigh 12 lb. to the gallon.

The covering capacity is as follows : 1 gallon covers on wood, 225 square feet ; 1 gallon covers on brick, 180 square feet ; 1 gallon covers on plaster, 270 square feet.

The time of applying, using a 4 in. brush is : Rough walls, 22 square yards per hour ; smooth walls 38 square yards per hour ; flat surface, 40 square yards per hour ; ceiling, 25 square yards per hour.

Fence Sign White.

(*a*) 6 lb. quicklime ; slack in 1½ gallon warm water ; keep covered while slacking.

(*b*) 4 oz. white resin ; dissolve in 12 fl. oz. boiled linseed oil.

(*c*) 6 lb. whiting ; beat up on 1 gallon skim milk.

Mix (*a*) with (*b*) while hot, then add (*c*).

Weather Whitewash.

(*a*) 8 lb. quicklime ; slack in 2 gallons boiling water.

(*b*) 1 lb. carb. soda ; dissolve in ¼ gallon boiling water.

(*c*) ¼ lb. common glue ; 1 lb. rice flour or pounded rice ; soak 8 hours in ¾ gallon cold water ; dissolve on water bath.

Mix (*a*) with (*b*), then add (*c*).

Washable Distemper.

(*a*) ½ lb. white glue ; soak 4 hours in ½ gallon cold water ; dissolve on water bath.

(*b*) ¼ lb. phosphate of soda ; dissolve in ⅛ gallon hot water.

(*c*) 16 lb. whiting or other pigment ; beat up in 1 gallon warm water.

Mix (*a*) with (*c*), then add (*b*).

Cold Water Paints.

1 lb. casein, 1½ oz. soda ash, mix with 10 lb. whiting, zinc oxide, clay, or other white pigment, or

1 lb. casein, 6 oz. Vienna lime, mix with 10 lb. whiting, plaster of Paris, etc., or 1 lb. casein, 1 oz. powdered soap, 2 oz. pulverised borax, 3 oz. dry carbonate of soda, mix with 10 lb. dry white pigment.

Washable Cold Water Paint.

7 lb. Paris white, 2 lb. zinc oxide, 2 lb. plaster of Paris, $\frac{1}{2}$ lb. white dextrine, $\frac{1}{4}$ lb. pulv. gum arabic, $1\frac{1}{2}$ oz. pulv. borax, 1 oz. pulv. alum.

Liquid Prepared Water Colour.

(*a*) 12 lb. quicklime slack in 3 gallons water.

(*b*) 3 lb. silicate of soda, thin with 1 gallon hot water, then stir in $1\frac{1}{2}$ lb. casein ; stir until dissolved.

(*c*) 2 lb. strong white glue ; soak 8 hours in $\frac{1}{2}$ gallon cold water ; dissolve in $\frac{1}{2}$ gallon hot water; dissolve on water bath.

(*d*) 2 lb. pulv. alum ; dissolve in $\frac{1}{2}$ gallon hot water ; then stir in 24 lb. Paris white or whiting.

Mix (*a*) with (*b*), add (*c*), then stir in (*d*).

COLOURS WHICH ARE FAST TO LIME.

In executing distemper or fresco painting upon ordinary plaster, a number of colours cannot be successfully used as the free lime in plaster acts upon the colour and bleaches it. Following is a list of the principal colours which are fast to lime, and are not affected. Most of the earth colours, such as Vandyke brown, red oxide, yellow ochres, siennas and umbers, Venetian red, Indian red, light red, lithopone, zinc white, whiting, cadmium yellow, ultramarine, cobalt blue, chrome green, emerald green, lamp black and all black pigments. (See also Tables at the end of this book.) The following test may be used to ascertain whether any particular colour is fast to lime or not :— First mix three parts of plaster of Paris to one part of freshly-slaked lime, add water, mix to a paste and place

in a frame or mould about one inch deep. Place the paste in this mould, smooth level on the top, and when set remove the frame. Now take the colour to be tested, painting all the surface of the plaster slab so formed, at the same time paint a small portion of cartridge paper, and when dry, put this away between the leaves of a book, so that the light cannot get to it. Expose the painted slab to strong light for twenty-four hours, and then compare the colour with the colour painted on the cartridge paper. If there is any difference between them, the colour is more or less affected by the lime.

As a further test, place the slab into a dish or other suitable flat vessel, pour in water until it nearly covers the slab, leaving, however, the painted surface just above the top of the water. Leave it in that condition for twenty-four hours, and again compare with the cartridge paper. The water will act upon the lime, and cause it to act in its turn upon the colour. Any water paint which will stand this test may be said to be quite fast to lime.

The substitution of washable distempers for oil paints in order to lessen the cost is becoming better understood among painters every day. The writer is by no means prepared to say that one or two coats of water paint, followed by a coat of oil paint, will produce a better result from the point of view of durability than a good oil paint of carbonate of lead or zinc all through, but he does assert most positively that where it is necessary to lessen the expense, the water paint under the oil paint will produce a far better job than could be obtained by using the adulterated oil paint which would be necessary in order to keep the price within the same limits. There is an immense amount of work done by the painter which does not justify the use of the very highest class materials, for instance, cottage and small villa property, workshops, factories, where a very high finish

is not always required, and if the work is primed with water paint and two coats of good oil paint are given on top of it, the job will be a good one. The prevention of blistering by the use of water paint above mentioned is very important and is not so well recognised among painters as it deserves to be. If a really good water paint is used it will cure the most obstinate case of blistering.

Another use for certain of the water paints which are supplied in dry powder, notably Alabastine, is for filling. The importance of having a level surface upon which to paint is well understood among painters, and the necessity is most marked in the case of enamel work, because the gloss would show up every inequality. A simple, cheap filling is made by Alabastine, and the cost is lessened also, because it may be so readily rubbed down.

CHAPTER XXII.

Artists' Water Colours and How to Mix Them.

The colours used in water colour painting in most cases bear the same names as those ground in oil for decorators' use, but there are a number of exceptions. For instance, the chrome green of the artists' colourman is similar to the Brunswick green of the house painter. All of the principal names will, however, be found under the head of the various chapters headed, "Red," "Blue," etc. Note is also made in the same places of those colours which are used exclusively in water and are not suitable for use in oil and *vice versa*. Plate XI. contributed by Messrs. Reeves and Son will repay a careful study.

Considering the large number of artists' water colours on the market it is obvious that no artist would, as a rule, have them all at hand. Indeed, from one to two dozen colours are usually quite sufficient for the use in all ordinary water colour painting. It may be taken as a safe rule that, within reasonable limits, the more restricted a painter's palette is, the better. By the kindness of Messrs. Madderton and Company, Ltd., of Loughton, Essex, manufacturers of artists' and decorators' colours, we reprint from "Notes for Artists," the palettes of several well known artists, and they may safely be taken as a guide.

Bell, Robert Anning, A.R.W.S.—Rose madder, pale cadmium, mid cadmium, deep cadmium, permanent yellow, cobalt blue, French ultramarine,

cobalt green (light), oxide of chromium (viridian), oxide of chromium (opaque), permanent Chinese white, Chinese vermilion, Venetian red (light red), golden ochre, raw sienna (light), trans. golden ochre, yellow ochre (Oxford ochre), terre verte, burnt umber, ivory black, raw umber, Turner brown, verona brown.

MacIntosh, J. M., R.B.A.—Light red, vermilion, rose doré, rose madder, purple madder, Venetian red, cobalt yellow (aureoline), pale cadmium, deep cadmium, lemon yellow, cobalt blue, French ultramarine, ivory black, sepia, yellow ochre, Roman ochre, raw umber, raw sienna, oxide of chromium (viridian), burnt sienna cobalt green, orange cadmium.

Severn, Walter, R.C.A.—Indian yellow, orange cadmium, aureoline, yellow ochre, orange vermilion, scarlet vermilion, alizarine, crimson, violet mineral, rose madder, cobalt blue, cyanine blue, emerald green, brown madder, transparent brown (dark), Payne's gray, ivory black.

Sir Francis Powell, P.R.S.W.—Pale lemon yellow, aureoline, yellow ochre, transparent orange ochre, raw sienna, raw umber, transparent brown (light), burnt umber, brown madder, burnt sienna Chinese vermilion, rose madder, alizarine crimson and scarlet, cobalt violet, alizarine violet, cerulean blue, cobalt blue, ultramarine, cyanine blue, transparent green, oxide of chromium, emerald green, ivory black.

Linton, Sir James D., R.I.—Brown madder, purple madder, ruby madder, scarlet madder, pale cadmium, deep cadmium, orange cadmium, cerulean blue, cobalt blue, French ultramarine, oxide of chromium (viridian), scarlet vermilion, burnt sienna, Venetian red (light red), raw sienna (light), Roman ochre, transparent golden ochre, yellow ochre (Oxford ochre), yellow ochre (light), Prussian blue, old terra verte, burnt umber, blue black, ivory black, raw umber, transparent brown (dark).

Bayliss, Sir Wyke, P.R.B.A.—Yellow ochre, lemon yellow, aureoline, raw sienna, light red, madder carmine, Chinese vermilion, cobalt blue, ultramarine, ash, Vandyke brown, sepia, burnt sienna, emerald green, ivory black, brown madder.

The following water colour palettes are taken from "The Chemistry of Paints and Painting," by Prof. A. H. Church (Seeley).

Sir John Gilbert, R.A. (15 pigments).—Chinese white, yellow ochre, raw sienna, vermilion, light red, Venetian red, Indian lake, cobalt, ultramarine (artificial), indigo, Prussian blue, Antwerp blue, burnt sienna, Vandyke brown, and ivory black.

Alfred W. Hunt (17 pigments).—Lemon yellow, gamboge, yellow ochre, raw sienna, vermilion, light red, Indian red, madder lake, terra verte, cobalt, ultramarine, ultramarine ash, smalt, madder brown, raw umber, burnt sienna, burnt umber.

A palette that is useful for flower painting for those not well versed in mixing colours is as follows: Raw sienna, burnt sienna, Chinese white, yellow ochre, gamboge, Indian yellow, lemon yellow, Prussian blue, French blue, cobalt, Naples yellow, emerald green, purple lake, crimson lake, pink madder, brown madder, brown pink, sepia, Vandyke brown, scarlet lake, scarlet vermilion, carmine, olive green.

It will be readily understood that from these palettes nearly any colour or hue may be obtained so that the artist has at hand means for obtaining any effects desired. Occasionally it may be found desirable to buy a small tube of some special colour for a special purpose or to obtain a special effect.

Although we have given below a few mixtures by which some colours can be imitated it is more important to the beginner in water colour painting to know the general effects of admixture and the purposes for which they may be employed. Mr. Frederick Oughton has copyrighted a colour chart for water

colour painting which the author recommends strongly to beginners for close study. It is published at 2s. 6d. by Messrs. Winsor and Newton, and consists of a sheet of cartridge paper divided into twenty-one numbered spaces. Upon each is given a wash of two or more colours, pure at the top and blended together immediately below, being lightened off by the addition of water as the colour reaches the bottom. The following colours are used : (1) Indigo, Vandyke brown, and alizarin crimson ; (2) French blue and brown madder ; (3) Cobalt, sepia, and alizarin crimson ; (4) Cobalt and light red ; (5) Cobalt rose madder and yellow ochre ; (6) Cobalt and raw sienna ; (7) Cobalt, rose madder and aureolin ; (8) Cobalt and yellow ochre ; (9) Sepia and gamboge ; (10) Indigo and yellow ochre ; (11) Indigo and gamboge ; (12) Indigo and sepia ; (13) Prussian blue ; (14) Prussian blue, burnt sienna and gamboge ; (15) Prussian blue and aurora yellow ; (16) Prussian blue and aureoline ; (17) French blue and alizarin crimson ; (18) Cobalt and rose madder ; (19) Rose madder and yellow ochre ; (20) Vermilion and gamboge ; (21) Vermilion and yellow ochre.

The chart indicates at a glance the different colours which are obtained by mixing the various pigments mentioned above after each number. The student might very well prepare for himself a number of such charts based either upon his individual fancies as to a palette, or by taking one or even several of those given above. It would be excellent practice to make a chart on every one of these palettes and to keep all the charts for constant study and inspection as recommended under the head of "How to Learn to Mix Colours."

How to Imitate Water Colours.

It will be noted in the following list that white, which is so important an element in mixing oil colours, is almost wholly omitted. The reasons for this are

first, that the addition of water to water colours produces a thin wash or a tint in the same manner as pigmentary white in oil colour; next, that if white pigment is added in any quantity to a water colour a chalkiness results and the tone of the colour is destroyed, and third that the paper or ground in water colour painting being usually white this forms an element which must always be considered. Moreover, crude white is very rarely employed in water colour painting excepting, perhaps, for small high lights and cloud effects.

The following brief list gives the mixtures by which some of the colours named may be imitated.

ALIZARIN GREEN.—Prussian blue and gamboge or aurora yellow.

BLUE BLACK.—Indigo and sepia.

BURNT SIENNA.—A close imitation may be obtained by mixing madder carmine and cappagh or Caledonian brown.

CADMIUM.—Chrome yellow with a very slight addition of burnt sienna.

CADMIUM ORANGE.—Add a little vermilion to medium cadmium yellow.

COLOGNE EARTH.—Prussian blue and sienna.

GRAYS.—A large series of grays suitable for skies may be produced by mixing either of the following colours with or without black as may be required: Lake and cobalt; lake and indigo; light red and cobalt; Indian red and cobalt; indigo, lake and burnt sienna; indigo, lake and gamboge.

HOOKER'S GREEN.—Prussian blue and gamboge or aureolin.

INDIGO.—Dark ultramarine with black and add a very little veridian, or mix Prussian blue, crimson lake and black.

INDIAN RED.—Tone vermilion with a very little yellow ochre and add madder carmine and ivory black until a match is made.

Light Red.—Mix together yellow ochre, vermilion and cappagh or Caledonian brown.

Madder Brown.—Vandyke brown and crimson.

Prussian Blue.—Add black and a very little veridian to ultramarine.

Neutral Orange.—Cadmium and Venetian red.

Raw Sienna.—Mix aureolin, yellow ochre, with cappagh or Caledonian brown.

Rose Madder.—Crimson lake with a little Vandyke brown.

Sepia.—Vandyke brown and black.

Vandyke Brown.—Tint cappagh or Caledonian brown with madder carmine and sadden with a very little black.

Venetian Red.—Mix together yellow ochre, vermilion and madder carmine and add a little cappagh or Caledonian brown.

Suggestions for Painters in Water Colour.

Although the above list may be useful under some circumstances the beginner in water colour painting will be more interested in learning the mixtures which may be successfully employed in various parts of a picture and to such the following hints will be useful for study. It must always be remembered that thin washes are, as a rule, intended.

Autumnal Tints (See also skies).—(*a*) Indian yellow ; (*b*) French blue and brown pink ; (*c*) Cobalt, Naples yellow, and rose madder ; (*d*) Gamboge and rose madder.

Banks, Earthy.—(*a*) Light red, yellow ochre, and Payne's grey ; (*b*) Gamboge and burnt sienna ; (*c*) Yellow ochre and Vandyke brown.

Bracken.—Yellow tints, yellow ochre, French blue and Indian yellow. Green tints : French blue and yellow ochre. Red tints : cadmium, Venetian red and burnt sienna.

Branches of Trees.—(*a*) Vandyke brown; (*b*) Brown madder with or without a little French blue; (*c*) French blue and brown madder; (*d*) Rose madder and blue black; (*e*) Sepia and brown madder.

Backgrounds.—It is almost useless to give mixtures for backgrounds, because to put it crudely anything will do for the purpose provided that it harmonises the picture itself or either throws in relief or acts as a foil as the case may require. The following are some useful backgrounds other than plain greys and grays which are so often employed. (*a*) Cobalt blue, Chinese white and emerald green; (*b*) Cobalt and brown madder; (*c*) Cobalt and scarlet vermilion with a little emerald green.

Clouds and Distances.—Mix thin washes, either of the following in varying proportions according to circumstances: (*a*) Cobalt, yellow ochre, and rose madder; (*b*) The same, omitting the cobalt; (*c*) Brown madder and cobalt; (*d*) French blue, burnt sienna, and crimson lake; (*e*) Indigo and blue black; (*f*) Cobalt and light red; (*g*) French blue and blue black; (*h*) cobalt, light red and rose madder; (*i*) Yellow ochre or Indian red with a little rose madder.

Clouds (Stormy).—(*a*) Blue black and light red; (*b*) French blue and blue black; (*c*) French blue, light red, and blue black.

Flowers and Fruit.—It is obviously impossible within the limits of the present work to give anything like a complete list of the different colours used in painting fruit and flowers; indeed, their number is infinite. A few of the most important, however, may be given. (*a*) Vermilion and gamboge (marigold); (*b*) Vermilion and yellow ochre; (*c*) French blue and crimson; (*d*) Rose madder and cobalt; (*e*) Rose madder and yellow ochre; (*f*) scarlet lake and cobalt (Christmas rose); (*g*) Madder and white or pink madder by itself (pink rose); (*h*) Scarlet lake and carmine (red rose); (*i*) Crimson lake and purple lake (dark parts

of cyclamen; (*j*) Crimson lake mixed with either purple lake, madder brown, Indian yellow or gamboge (carnation).

Foliage, Grass and Herbage.—Clearly a wide range of greens, reds, and yellows may be employed for these purposes. The following are some suggestions. (*a*) Veridian and French blue; (*b*) Gamboge and sepia; (*c*) French blue and emerald green; (*d*) Emerald green and gamboge; (*e*) Indigo and gamboge; (*f*) Indian yellow and burnt umber; (*g*) Indian yellow and French blue; (*h*) French blue, Indian yellow and burnt sienna; (*i*) Yellow ochre and French blue; (*j*) French blue, rose madder and yellow ochre; (*k*) Indigo, light red and yellow ochre; (*l*) Gamboge, burnt sienna, and French blue; (*m*) Burnt sienna, Indian yellow and French blue; (*n*) Yellow ochre, gamboge, French blue, and burnt sienna.

Foliage and Herbage (Distant).—(*a*) French blue and brown pink; (*b*) Yellow ochre; (*c*) Brown pink mixed with French blue and either burnt sienna or Vandyke brown; (*d*) Naples yellow and cobalt; (*e*) Cobalt and lemon yellow; (*f*) Naples yellow, yellow ochre, and cobalt.

Foregrounds.—(*a*) Brown pink, either by itself or mixed with burnt sienna, Vandyke brown or gamboge; (*b*) gamboge and yellow ochre; (*c*) Yellow ochre and cobalt, with or without a little light red.

Grass.—(*a*) French blue and gamboge; (*b*) Indigo and gamboge; (*c*) French blue mixed with gamboge and yellow ochre or Indian yellow; (*d*) French blue and yellow ochre.

Grays, Warm and Cold.—For clouds, hills and distant effects. To get these mix either of the following, depending upon the circumstances:—Mix cobalt with either (*a*) Light red; (*b*) Raw sienna; (*c*) Sepia and crimson; (*d*) Rose madder and aureolin, or (*e*) Rose madder and yellow ochre. Mix indigo with

crimson and Vandyke brown or mix French blue with brown madder.

Ivy.—(*a*) Indigo and burnt sienna; (*b*) Yellow ochre, brown madder and French blue; (*c*) Brown madder, French blue, and a little cobalt.

Leaves and Stems of Flowers.—Here again a very large variety of greens might be given, but the following list will be found to suit most requirements: (*a*) Naples yellow or gamboge mixed with a little emerald green; (*b*) Cobalt or French blue mixed with carmine and Naples yellow; (*c*) Prussian blue and gamboge; (*d*) French blue, gamboge, and yellow ochre; (*e*) French blue, raw sienna, and gamboge; (*f*) French blue, scarlet lake, and a little Naples yellow. Note: This gives a delicate bluish mauve suitable for the under part of the leaves of the cyclamen; (*g*) Indian yellow, gamboge and Prussian blue; (*h*) Olive green used alone or mixed with a little raw sienna, white or Prussian blue; (*i*) Prussian blue, sepia and raw sienna; (*j*) Cobalt gamboge and yellow ochre. This list might be added to almost indefinitely, but inasmuch as several greens are usually to be found in the palettes of most painters further examples are not necessary.

Mountains.—(*a*) Yellow ochre, cobalt and rose madder; (*b*) Either two of the three last mentioned; (*c*) Cobalt, rose madder, and raw umber; (*d*) Light red, rose madder, and cobalt.

Rivers.—The colours used will depend, of course, upon the state of the river. If it is calm raw sienna with a little Vandyke brown and cobalt will answer. If dark, Indian yellow, sepia, and lake may be used, or Vandyke brown, Indian yellow and lake.

Roads.—(*a*) Rose madder, burnt umber, and indigo; (*b*) Light red and blue black; (*c*) Yellow ochre; (*d*) Yellow ochre, light red, and either Payne's grey, or a little cobalt; (*e*) Yellow ochre and Vandyke brown.

SEA.—(*a*) Cobalt mixed with either light red, burnt sienna or lake, and yellow ochre; (*b*) Indigo, yellow ochre, and rose madder; (*c*) Raw sienna mixed with blue black or cobalt.

SHADOWS.—The colour of shadows will, of course, always depend upon the colour of the object upon which they are thrown. The following mixtures are among the most useful—

(*a*) Brown pink, French blue and lake; (*b*) Lake and Indigo; (*c*) Blue black, lake and burnt umber; (*d*) Cobalt rose madder and yellow ochre.

SHADOWS, ESPECIALLY OVER FLESH COLOUR.—Mix cobalt and raw sienna.

SHADOWS (FOREGROUND).—When a purple shadow is required use either (*a*) Cobalt mixed with rose madder; (*b*) French blue and crimson.

SHADOWS (GENERAL).—Vary either of the following: (*a*) French blue, burnt sienna, crimson lake; (*b*) Cobalt, raw and burnt sienna.

SHADOWS (WARM AND COLD).—(*a*) Sepia, indigo, and crimson lake; (*b*) Indigo and light red; (*c*) Crimson lake and blue black; (*d*) Light red and blue black; (*e*) Indigo and Indian red.

SHIPS (HULL).—(*a*) Burnt sienna; (*b*) Lake and Vandyke brown; (*c*) Burnt sienna, brown madder and blue black. SAILS: (*a*) Raw sienna; (*b*) Yellow ochre, and umber; (*c*) Roman ochre; (*d*) Brown madder and light red.

SKIES.—Skies may vary from differently toned grays to pure cobalt: Under the head of grays on page 110 will be found a number of different mixtures most of which are suitable for sky work. The following are additional mixtures:—

(*a*) Cobalt and rose madder; (*b*) Indigo and Indian red; (*c*) Cobalt and a little Chinese white or (*d*) Cobalt by itself.

STONE WALLS.—(*a*) Rose madder and blue black; (*b*) Yellow ochre and Vandyke brown; (*c*) Blue black

(*d*) Indigo and sepia ; (*f*) Yellow ochre and blue black ; (*g*) Yellow ochre, light red and blue black.

Sunset and Sunrise.—The same as Autumnal Tints, which see.

Trees : Distance and Middle Distance.—Use either of the following : (*a*) Indigo and gamboge ; (*b*) Sepia and gamboge ; (*c*) Cobalt and yellow ochre ; (*d*) Indigo and yellow ochre ; (*e*) Indigo and sepia ; (*f*) Cobalt, lake and yellow ochre ; (*g*) Brown pink, indigo, and burnt sienna ; (*h*) Gamboge, light red, and indigo.

Trees (in the Foreground).—Either of the following mixtures will serve : (*a*) Prussian blue, gamboge, and burnt sienna ; (*b*) Prussian blue and aureolin ; (*c*) Prussian blue and aurora yellow and Prussian blue and burnt sienna ; (*d*) Gamboge, yellow ochre, and indigo ; (*e*) Gamboge, burnt sienna, and indigo ; (*f*) Naples yellow, Indian yellow, French blue, and a little burnt sienna.

CHAPTER XXIII.

Testing Colours.

Although to accurately test the quality of a colour requires somewhat elaborate experiments, both chemical and practical, yet there is no reason why the painter should not determine with a sufficient degree of accuracy for his purpose the quality of the colour he uses. Indeed, if this was done more generally, many of the grossly indifferent colours would be driven from the market, and none would rejoice more at such a result than the colour manufacturers themselves. The writer has no connection with, or interest in, these manufacturers, but it is only fair to assert that they are as desirous that the trade should use pure colours as the painters can possibly be. Even the largest houses produce cheap grades of colours, and this they do almost under a protest and simply because they are compelled by painters demanding colours for certain low prices, far below that at which it would be possible to produce the pure article. As a rule such adulterated colours do not bear the name of the maker. Our advice to painters is: Make a careful comparison between pure colours and those you are using. At the same time, compare the prices and then see which is cheaper to use. If even they come out at the same price, remember that by using a pure colour you will have all the benefit of that purity of tone so necessary for the execution of good work.

The first thing to be done in testing any paint material is to have a standard. There must be no doubt about this. Unless we have in each case something with which to compare the particular sample of colour that is being examined, we shall have no useful information concerning it. Take, therefore, good decorators' colours of well known make. If necessary purchase small tubes of the best colours, such as are put up for artists' use. This will be rather a severe trial, but still it will afford a standard. Having such samples and going through the tests we are about to describe, the painter can, after some amount of trouble, arrive at results which are almost as accurate as those which could be deduced by a chemist. An expert on this question some years ago summarised the characteristics of colours which should be considered in making the examination, under the following heads :—

1. Purity of the material.
2. Purity of the tone ; brilliancy ; richness, which indicate the amount of care in selection.
3. Fineness of grinding or preparation ; this means the degree of the division of the particles and upon the completeness of such division the durability will in a great measure depend.
4. Its spreading capacity.
5. Its body. This applies, of course, only to opaque or semi-opaque colours. Body is opacity, and means capacity to conceal the surface to which the paint is applied, and must not be confused with spreading. It is an inherent quality.
6. Its staining power or tinting strength with white or colours.
7. The quality of purity of the tint obtained by mixing with white.
8. If a paste colour, the consistency of the paste.
9. Transparency of transparent colours and the quality of the transparency.

10. The permanency of the colour.

It will be observed that all of these tests will not necessarily be applied to every colour. For instance, a transparent colour would be tested for its transparency, but certainly not for its body. The one condition is the converse of the other.

We will now consider the above-named qualities separately.

Purity of the Material.—This is sometimes of considerable importance, as in the case of white lead, whilst in others—for example the earth colours—it can hardly be said that there is a standard of purity. As a rule a knowledge of practical chemistry is necessary in order to determine whether a sample of paint or colour is pure or not.

The purity of white lead, however, can readily be ascertained by the painter who possesses no chemical knowledge, viz., by aid of the blow-pipe. Take a piece of flat charcoal and scoop out a hollow space from it into which place a small piece of white lead to be tested, about the size of a pea. Now direct the flame of a blow-pipe upon it, using an ordinary paraffin candle or a Bunsen burner, taking care that the blue portion of the flame bears upon the lead. Keep up a steady blow for a few minutes and the white lead will be converted into metallic lead, which will show in the form of a bright silver-like button. If the lead is adulterated the blowing will only have the result of making it appear like a cinder. To conduct this experiment successfully requires a little practice with the blow-pipe in order to obtain a steady flame.

Another method of testing is to place a little white lead in a crucible and place this on a hot fire, when, if genuine, it will be converted into metallic lead.

A form of blow-pipe that may be purchased at most ironmongers' shops consists of a wooden handle and a container filled with cotton soaked in benzine. To this is attached a rubber tube with a mouthpiece.

This blow-pipe is very easily used, and may be successfully employed in testing the purity of white lead in the manner indicated.

Purity of Tone.—Some remarks on this subject will be given under the heads of the various groups of colours. Speaking generally, the richness of brilliancy of tone is easily discernible by placing the sample to be tested side by side with another of well known excellence. In siennas, ochres and umbers the selection of crude material by which the richness of tone is assured is of great importance.

Fineness of Grinding.—The method of testing the fineness of a pigment usually employed by the painter is to rub a little on the finger nail; but this is a crude and unreliable method. If the pigment is dry and it is desired to compare it for fineness with a similar pigment or white lead, the following is as good a plan as any :—

Take two tall vertical glass jars, place in them an equal amount of turpentine, and then take a small quantity of the white lead to be tested. Place it in one jar, and an equal quantity of the pigment with which it is to be compared, in the other; thoroughly stir up both and then note the time it takes the samples to settle. If graduated marks are made on the two jars the observations will be taken more readily.

Another test is to weigh out equal quantities of the two leads, and then to take a very small quantity of the same colour, say black, and add to each sample, thoroughly mixing. The lead that is the lightest in colour will be the finest. The explanation of this is somewhat interesting. Suppose that we have a number of cubes of white lead each measuring one inch side. This will give us six superficial inches to be coloured. Now suppose that we break up these inch cubes into half inch cubes, which will give eight half inch cubes to each inch cube. Now as each half inch cube has six faces measuring half an inch by half an

inch, it has a superficial surface of three square inches ; and as there are eight of the half inch cubes, there are twenty-four superficial inches to be coloured against six in the inch cubes. It will be seen, therefore, that by increasing the fineness of a pigment a greater surface is presented to be coloured, and hence more colour is required.

Another test for fineness is to paint different samples thinned in turpentine on plate glass ; when dry the two specimens may be compared, and the difference of fineness between them will soon be apparent.

Still another test, and one frequently used by painters, is to place a quantity of the colour ground in oil that is to be tested upon a level surface such as a piece of glass, and to run the blade of a spatula or palette knife over it, and then over another sample with which it is to be compared, noticing carefully the difference in appearance of the two samples. By these means the presence of grit is discovered.

Spreading Capacity or Covering Power.—The spreading capacity of pigments and their "body" are very nearly related, although of two equal in body one may possess greater covering power or spreading capacity than the other. A practical method of testing covering power is to mix a small quantity of a standard paint and an exactly similar quantity of the pigment to be tested, taking care to use precisely the same amount of oil and thinners in each case. Then taking a clean brush for each of the paints, paint a door, or other surface that has been primed, on two panels side by side, continuing to paint till all the pigment has been in each case used up. The one that goes farthest has the greater covering power.

In comparing the two it will be well to notice whether the body is equal to both cases, as one may go farther but not cover so well.

Body.—The word "body," as applied to pigments, is almost synonymous with opaqueness. It is the most important property of a pigment, and it is because white lead possesses the quality in an eminent degree that it is so much valued.

Body is sometimes called "covering power," but this term is a little misleading, as some may suppose it to relate to the spreading capacity of the pigment.

If two different white leads ground in oil to an equal consistency be applied to different panels of a door, primed in the same manner, the one of the two leads that possesses the better body will be shown by it hiding the grain of the wood better. Some white leads, especially those that are manufactured by the new processes, lack this important quality of body, and three coats will only cover the work as well as about two of old process white lead.

There are numbers of methods of practically testing the "body" of pigments, among the simplest being the following.

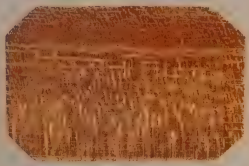
Prime and paint a board with alternate black and white squares, like a chess- or draught-board. Take a sample of a pigment, similar to that to be tested, of which the body is known to be good, and paint a wide strip across the chess-board; then paint a smaller strip of the pigment to be tested. When both strips are dry, by comparing them one can tell almost at a glance which has the better body, the superior pigment covering or hiding the black squares better than the other. A second coat may afterward be applied to each over a portion of the strip, if desired.

It may be again mentioned that in all cases of practically testing paints the results are obtained by comparisons being made, and hence it is necessary in every case to have a standard with which to compare the sample to be tested as has already been explained.

The test of painting over squares of black and white may be varied by using stripes instead. The test

Color Mounting

CELLULOID FINISH



STAIN ON VENEER

OIL FLAT

VARNISH FINISH

VARNISH STAIN ON VENEER

DISTEMPER

METALLIC PAINT

SCUMBLE ON CELLULOID

This plate is prepared to show the various finishes obtained for Color Card work by :—

WHITE & FARRELL, Ltd
HULL.

answers equally well for white lead, zinc, lithopone or any pigment of which the quality of body is of importance. In some colours it is of little moment.

TINTING OR STAINING STRENGTH.—We have already explained at length how greatly the tinting strength of different colours or stains varies. Any painter can test the tinting strength of any colour himself in a very simple manner. All that is necessary is to have a pair of apothecaries' scales, some blotting paper, a palette knife, some pieces of glass or a flat piece of marble and some pieces of waxed paper. First weigh out say eighty grains of dry white lead or dry zinc. Any other white will answer equally well. Place these eighty grains on one side of the glass and the second eighty grains on the other. Now take the dry colour and weigh one grain and add that to one of the little piles of white, then weigh a grain of the standard colour and add that to the other pile. Next add to each pile a few drops of oil, taking care that the number of drops is the same in each case. With the palette knife thoroughly mix until no streaks can be seen and the mixture is perfectly uniform. Then by comparing the two the difference in tinting strength will at once be apparent. The same result would have been produced had ordinary white lead ground in oil been used instead of dry lead or zinc. If the colour is ground in oil a little difference in the method must be observed, the reason being that one colour might be ground much thinner than the other, in other words might contain much more oil than the other, and hence if equal weights of each were compared the result would be misleading. Take then each colour in oil—that is the standard and the colour with which it is to be compared—place on a small quantity of blotting paper and allow it to remain a few minutes so that the oil may be extracted. If it is thought necessary the sample can be washed with benzine, but for painters' purposes the extraction of the oil by means of blotting

paper is sufficient for the purpose. The two samples having remained on the blotting paper for a short time one grain of each is weighed out separately on little pieces of wax paper, this being used so that the colour shall not stick to the scale. Then each grain is mixed separately with the white and the result compared as before. It is not too much to say that every painter should be prepared to make this test, because it informs him not only as to the tinting strength of the colour, but also gives valuable information as to the tone, etc. Of course the quantities may be varied if necessary, and a larger amount used instead of the single grains. It need hardly be pointed out that scrupulous cleanliness is necessary for successfully carrying out this test. The palette knife must be wiped between each operation and every care taken to do justice to both samples.

If the reader will turn to Plate I. in this work he will see a number of colours given in their full strength, and also when reduced with certain parts of white, as marked upon the sheets. The colours used in the preparation of this sheet were of excellent quality, and it will prove interesting no doubt to the student to mix the colour he has been in the habit of using in the same proportion with white, and to note whether the results come out above or below those shown by our samples.

The Permanence of Colours.—It must be admitted that it is very disappointing to a painter to find, after taking pains to produce the exact colour required, that it "flies" or fades after a little exposure to the weather. The tests for the permanence of a colour when exposed to light are simple enough, and are to mix a little of the colours to be tested in oil and to spread them on different slips of paper, cut the paper in half, number each half with corresponding figures or letters, expose one half to a strong light for as long as may be deemed desirable and put the other half away

into a safe place where the light does not penetrate. Waxed paper is the best, as it will not absorb the thinners or, better still, glass may be used, this being cut across with a diamond after the paint has been applied. It need hardly be said that the permanence of water colours is entirely different from that of oil colours. Some very useful experiments were made several years ago by Captain Abney on the permanence of water colours, and these were published in the form of a blue book. In the lists of colours which are given in the preceding chapters, the quality of permanence or non-permanence under various conditions is given in each case.

COLOURS FAST TO LIGHT.

Some colours fly or fade very quickly, while others are perfectly permanent. In the lists of mixtures under the head of "Reds," "Blues," etc., in this book, will be found a list of all the colours on the market and a note is made in each case whether the colour is permanent when exposed to light or not.

The method of ascertaining whether a pigment is fast to light is recommended by GEORGE H. HURST in his admirable book, "Painters' Colours, Oil and Varnishes," and is as follows.

Probably the simplest method (which is a very good one) of testing the durability of colours, is to provide a sheet of unglazed cardboard; that known as Bristol board will do very well. It must have so slight an absorbent property that if any coat of paint is placed on the surface it will remain there, and not soak into the substance of the cardboard. This sheet of board is ruled into squares or rectangles measuring about 3 in. by 3 in., or 2 in. by 2 in.

A little of the colour to be tested is ground up with a little gum water into a smooth paste, and a portion of one of the ruled spaces on the cardboard painted with it. It is advisable to rule and prepare two

sheets at the same time. The name of the colour can be written either underneath the patch of colour in the square, or in a corresponding position on the back of the card. It is also advisable to grind a little of the pigment with oil, so that the relative durability as a water colour and as an oil colour can be tested.

One of the prepared cards is hung in a place where it is exposed to as much sunlight and air as possible, while the other card is placed in a drawer away from any such influence. After a week or two of exposure the cards can be compared to see if any changes have occurred ; they can then be replaced in their respective positions, and from time to time compared together. Any change which may have been brought about by the action of sunlight and air on the exposed card will be observable ; some colours will be changed in a few weeks' exposure, other colours require months of exposure to produce any effect.

By placing a card painted in the manner described, with different pigments in a closed cupboard, in which is placed a vessel containing some ferrous sulphide and diluted sulphuric acid, the action of sulphuretted hydrogen on the colours can be tested ; if any are affected by this test it is certain that they will be similarly affected when exposed to the action of impure air.

We may now take each colour separately, following the order taken by the late Mr. W. C. Wilson, who arranged the above quoted table in conjunction with the author.

Chrome Green.—This colour is often made by the addition of a base such as barytes, but the presence of this material is not necessary. A number of different shades of chrome green are sold, usually designated pale, mid (middle or medium) and deep. The tinting strength should be tested by mixing one part of green to, say, a hundred parts of white lead or zinc, as explained elsewhere, or twenty-five parts of

lead may be used to one part of green. If it is desired to find out the relative strength for tinting purposes of the green, it can be done very simply in the following manner, but the painter must have a pair of apothecaries' scales, in order to weigh the different quantities. Take first the same quantity of the green which is being tested as that of the standard. If the colour is not so deep add more green each time, and more and more until the two samples are exactly the same tint. By comparing the weights the experimenter will have accurately the relative value of the two greens for colouring purposes. The test for body of the green is performed in almost exactly the same way as that already described for white lead. Prime a board thoroughly so that there may be no absorption, paint across the centre of it a stripe of white and by its side a stripe of black. When this is thoroughly dry take the two greens; that is, the standard and the one being tested. Then mix both with exactly the same amount of oil and turpentine. Take a clean brush for each and paint over the black and white stripes. The one which has the greatest body will, of course, hide the stripes better than the other one. The experiment is simple, and is very useful as a body tint.

Bronze Green.—This colour is usually mixed by the painter and not bought ready made, although all manufacturers make bronze greens. Quaker green is practically the same thing. The mixture usually employed is ochre, lamp black and a little yellow. The chrome should be either yellow or orange, but not lemon. Bronze greens may be made in a large variety by varying the quantities of the colours mixed and by introducing sienna, umber or Indian red in small quantities as may be required. The colour is very rich, and many cheap bronze greens consist of a considerable quantity of adulteration.

Emerald Green.—This is a very brilliant green almost identical with spectrum green. It is

sometimes used where brightness is required. When ground in oil the test for purity is to dissolve it with benzine and when the dry powder is obtained to treat it with strong ammonia. It will thus entirely dissolve if pure, giving a deep blue colour.

VENETIAN, INDIAN AND TUSCAN REDS, ETC.—These colours may be classed as the iron colours, consisting largely of oxide of iron. It should be remembered that ochres and umbers also receive their colouring from iron. Analysis gives but little information concerning the value of this group of colours. They form economical paints, especially as they spread well. The proportion of oxide of iron contained is often considered to be an indication of quality, but this refers particularly to cases where paint is to be used on iron. The tests of value to the painter are body and fineness of grinding, which may be tested in the usual way. Oxide paints are usually sold as such in three shades. A Venetian red is lighter than an Indian red, which, in comparison, should have a purplish tint. It must be remembered in this class of colours that a comparison of the same shades must be made if any useful result is to be obtained.

TUSCAN Red is a mixture of Indian red with some sort of lake colour in order to secure brilliancy. This brilliancy forms an important feature of the test. Body should also be ascertained, and fineness of grinding is also important. A Tuscan red, which is coarse, may lose its richness when ground fine.

INDIAN RED.—This is shown by analysis to consist almost wholly of oxide of iron. The paler Indian red is, the greater is its tinting strength, and the rosier is the tint obtained from it by mixing it with white. Indian red should be always tested for fineness and tint.

VERMILION AND VERMILIONETTES.—Many of the imitation vermilions consist of orange red, that is, a superior red lead coloured with eosine, which is the

name of one of the coal tar colours. Speaking generally, the scarlet colours are more permanent than those having a crimson tinge. It is important to know that the tinting strength for many vermilionettes is no indication of their quality, or rather, perhaps it should be said that within reasonable limits the better stainers they are, the worse colours they will prove to be. This is because barytes or some other mineral may be substituted for the orange red and then the eosine will go farther in staining.

Red Lead.—Every painter knows that formerly the great objection to the use of red lead was that it hardened quickly. During the past few years, however, marked improvements have been made in the manu facture and large quantities of ready-mixed red lead are now sold. The usual manner of painting iron, etc., in red lead is to first give a priming coat of pure lead and then a second coat of any colour desired. An excellent second coat is formed of equal parts by weight of red lead and good iron oxide. Any finishing coat may be applied.

Chromes.

There are many shades of chrome yellows sold, the most usual being lemon, medium and orange chromes, sometimes called 1, 2, and 3. The other shades are sold under various names, depending upon the manufacturer. It is advisable that the painter should always have on hand the lighter shades, as although it might appear at first sight that on mixing the deeper shades with white he would get the same result, as a matter of fact there is a considerable difference. As noted elsewhere, chromes must not be mixed with ultramarine. The pale chromes change colour quicker than the darker shades. Pale chrome should never be used on fresh plaster, although orange chromes may. In the deeper shades of chrome orange

red is sometimes used as an admixture or adulterant, but this is not a good stainer. The test for a chrome is tinting strength, taking care to make a comparison with the same grade of colours, that is, light, medium or orange chrome. Fineness is another important test. Placing a small quantity on glass and passing a palette knife over it and pressing firmly will detect grit if present. In the lighter chromes it is well to look for the greyness of tone which is objectionable. Chromes mix well with white lead and are strong in body.

Ochres.—Analysis is of no value in determining the value of an ochre. Sometimes chrome yellow is used to tone it up. The colour is an important feature, as is also the fineness.

Blacks

There are a number of blacks on the market, drop black, ivory black, blue black, vegetable black, carbon black, etc. The subject of their tests is a somewhat intricate one, but its tinting strength can be readily ascertained by mixing with white lead or zinc in the manner already described. They are frequently adulterated with barytes.

Blues.

Prussian blue must be very finely ground or it is likely to settle out. A pure Prussian blue has a rich bronze appearance when looked at from certain points of view. The tint made by mixing with white should be clear and free from any leaden or gray appearance. Some Prussian blues have a certain red or purplish cast which cannot be removed. These should be avoided, as if a purple is required it is a simple matter to add a little red to the blue to produce the desired colours. One part in a hundred of good Prussian blue gives a distinct sky blue.

Ultramarine.—As explained elsewhere, this colour cannot be mixed with white lead. Where it

is necessary to make a tint, zinc white should be employed in preference.

Umbers and Siennas.

The colour should be a rich brown rather than a red cast. In siennas prepared for grainers' use, it is important that they be transparent rather than opaque. Richness and quality of tint should be considered rather than the body.

CHAPTER XXIV.

Notes on Colour Harmony.

Perhaps the most difficult subject with which the decorator has to deal is that of colour harmony. In other words, how to use different colours in decoration in such a manner as to produce a perfectly harmonious and pleasing result. The subject is a difficult and comprehensive one, and it would be impossible within the limits of this book to do justice to it. A few general hints, however, will no doubt be of service.

It should be first recognised that there are distinct rules and laws regulating harmony in colour. Just as some people have an ear quick to recognise the slightest discord, so some are fortunate enough to possess an inherent talent for recognising colour harmony. It is to be feared that while the musical ear, so to speak, is fairly common, the ability to harmonise colours is much rarer. Speaking generally, ladies have more natural talent in matters concerning colour than men have. Possibly the reason is that they are called upon more frequently to choose and determine upon matters relating to colour in connection with their dress. It is true that if one is inclined to be satirical one might suggest that some ladies, judging by the extraordinary combination of colours they wear, must be colour blind.

It has been proved by statistics that one person in ten is colour blind, but this does not mean wholly devoid of the ability to distinguish one colour from

another, but simply that there are certain colours which the person who is colour blind cannot distinguish from others.

In almost everyday work the painter is called upon to mix colours that shall harmonise, as, for instance, to paint the woodwork of a room in colours that will harmonise with the wall-paper.

Matching the Wall-paper.—The simplest plan, and therefore the one which is usually followed, is to take the prevailing colour of the wall and to use it, usually much lightened, on the woodwork. Other colours which occur in the paper may be introduced as may be thought to be judicious. For example, if the room is a bed-chamber and the paper has a cream ground with a floral pattern printed in green with a pink flower, the stiles and rails of the doors might be painted a light green, the panels cream, and the mouldings, or a portion of them, pink. The same plan may be followed successfully with many papers, but on the other hand much more pleasing and artistic results may often be obtained by using a distinct, but harmonising contrast. A single example will suffice. The writer has before him a striped wall-paper, printed in brilliant sealing-wax red, which might cause wonderment in the eyes of a novice as to how it could possibly be used successfully in an ordinary room. The excessive brilliancy might at first sight appear to be certain to produce an effect too glaring to make a comfortable living-room. Yet such a paper used in a room very soberly furnished say, with old dark oak, ebony or black walnut, would look very handsome, or in a more modern room the doors, skirting, in fact the whole of the woodwork, might be finished in white enamel, and the effect would also be very good.

Contrasting Harmonies.—From this single example it can readily be seen that contrasting colours often give the very best results. A wall painted green

may look very monotonous, but if a frieze, having some bright red used liberally in it, is used in conjunction, there will be a vast difference in the appearance of the apartment.

This subject is dealt with at some length in Chapter VI.

SUGGESTIONS FOR COLOUR SCHEMES.

For a Red Wall.—Red may graduate from Indian red to what would practically be a warm gray. Any colour going with a selected tone or tint needs to be modified so as to harmonise with it. If a wall has a paper coloured in light red and gold, and it is desirable that the woodwork should be red too, it must differ from the colour of the wall in tone and in intensity.

A Crimson Wall may have amber woodwork with cream coloured mouldings, or they may be heliotrope for contrast, or the woodwork may be white.

A Scarlet Wall may have light snuff brown, or a sage green, for the woodwork, with yellow green mouldings, or they may be white.

A Yellow Red Wall, in which scarlet has been tempered with an excess of chrome, will bear a raw umber tone of brown for the woodwork, with ivory or white mouldings.

A Pink Toned Wall.—With this the woodwork may be a yellowish green, with or without straw coloured mouldings, or two shades of citrine, with pearl grey for contrast in the mouldings.

For a Dark Red, inclining to purple, the woodwork may be a sage or myrtle green, with amber mouldings.

A Poppy Red.—Grey green, lavender and black may be used for this.

All warm tones and shades of green or gray may be used with red, provided they get their hues by contrast with the red. Any blue associated with red must be slatey or purple in tone. If the colour of a

wall-paper is heliotrope, inclined to red, the woodwork may be cream. If the heliotrope inclines o yellow, straw colour should be adopted.

Blue.

A Blue Wall of a Purple Tone.—With this yellowish orange, amber, salmon pink or terra cotta will harmonise according to the "value" of the wall colour.

A Peacock Tone of Blue Wall.—This calls for orange red, deep amber, warm brown, cool brown, or both.

A Sapphire Blue Wall.—Chocolate woodwork in two tones, with amber mouldings. Pearl grey and cream will go with this colour.

A Wall of an Ultramarine Tone.—Light warm grey and cool yellow brown go happily with this.

A Neutral Blue Wall will unite with citron and chocolate, or a warm grey green, or a blue green grey, and salmon.

A Slate Coloured Wall of a Blue Tone.—For this there is plum colour and lavender, puce and orange to choose from.

Yellow.

This colour ranges from a rich sienna to a lemon tone; from citrine to a cream.

A Yellow Wall.—Plum colour, slate, brown, or citrine may be used with this.

A Gold Coloured Wall.—The woodwork may be in two tones of lavender, with citrine mouldings.

An Orange Coloured Wall.—The colour for the wood may be a purple tone of red, with maroon mouldings, or if light mouldings be required, citrine would serve.

A Canary Coloured Wall.—Vellum colour, with deep ivory mouldings, may be adopted for the woodwork.

A Deep Terra Cotta Wall.—A selection from buff, sage green, Indian red, vermilion, white and black

either or any, may be selected, the strong colours in the small parts.

A Primrose Tone of Wall.—Tones of snuff brown, medium yellow green, and lavender may be selected.

A Neutral or Drab Wall.—Shades of olive green, Venetian red, and lilac go well together.

Brown.

This colour is perhaps the best wearing colour for woodwork. There are infinite tints and shades, from sober to rich, from cool to warm. Blue agrees especially with brown.

Deep brown, light blue, and gold go well together.

Light Purple Tone of Brown Wall.—The woodwork may be yellow red, with cream mouldings.

A Brown Ingrain Wall.—The woodwork may be in two tones, made from indigo blue, with amber mouldings.

A Gold Coloured Brown Wall would unite with woodwork of a red tone of purple, with plum coloured mouldings, or a warm grey may be used.

Burnt Sienna Brown Tone of Wall.—With this, salmon and myrtle harmonise.

Green.

This colour, so extensive in Nature, will agree with all colours, provided they are toned to suit each other, warm or cold, neutral or bright, etc.

An Olive Green Wall will agree with maroon woodwork with a crimson lake, straw or pink tone for the mouldings.

A Medium Green Coloured Wall.—If two tones of red, a crimson tone and a yellow tone be adopted, the mouldings, if desired, may be a salmon buff.

A Grey Green Wall may have a primrose tone of woodwork, with a scarlet tone for mouldings.

A Moss Green Tone of Wall will associate well with citrine woodwork, and salmon coloured panels or mouldings.

A Pea or Leaf Green Wall goes well with a chocolate and a lavender.

Grey.

This neutral colour agrees with and helps every other colour.

A Warm Gray Wall.—With this the woodwork may well be a tawny leather colour, with either buff or cream in the mouldings. A quiet red would also suit.

A Silver Grey Wall sympathises with a salmon colour, as well as with a deep blue. Should there be blue and red in the pattern on the paper, the styles of the woodwork could then be a delicate raw umber tone of brown. The mouldings the same brown, with burnt sienna added to it. The panel may be a cameo pink. A snuff coloured brown would also come well.

A Drab Tone of Wall, having an ornament upon it, low in tone, a citrine for instance, would need some force in the woodwork. A rich burnt sienna brown suggests itself for this, with a reddish brown for the mouldings.

Of course, these schemes of colour can be reversed. Should the general tone of the wall-paper be that tone suggested here for the woodwork, it takes then the colour of the paper.

Colour Combinations for Doors.

Excellent results may be obtained in painting front and other doors in rich contrasting colours or in self-colours, *i.e.*, a dark colour for the frame of the door and a tint of the same colour for the panels.

The following combinations are recommended as producing very good effects. They were carried out

in doors prepared by Messrs. Lewis Berger and Co., Ltd., for some of the conventions of Master House Painters and Decorators.

FRAME.	MOULDING.	PANEL.
Yellow, Bronze and Golden Ochre.	Carriage Green.	Yellow, Pale Bronze.
Homerton Red.	Carriage Green.	Maroon Brown.
Mid. Japan Brown.	Maroon Brown.	Deep Japan Brown.
Vienna Lake and Pompeian Red	Maroon Brown and Black.	Coronation Red.
Mid. Japan Brown. (reduced $\frac{1}{15}$).	Deep Japan Brown.	Mid. Japan Brown.
Verona Blue.	Maroon Brown.	Vernon Blue and White
Coronation Brown.	,, ,,	Coronation Orange.
White Japan.	,, ,,	,, ,,
Deep Japan Brown (reduced).	Deep Japan Brown.	Berger's Purple.
Emerald Tint S.	Olive.	Emerald Tint W.
Purple	Maroon Brown.	
Maroon Brown.	Homerton Red.	Homerton Red.
White Japan.	Gold Lined.	White Japan.
Cream.	Green.	White.
Hedge Sparrow Egg Tint.	Stone Colour.	Old Gold.
Japanner's Brown Mid. 37.	Same Brown Deep Shade	Japanner's Brown, Mid. 37.
Japanner's Brown Mid.	Maroon Brown.	Japanner's Brown, deep.
Purple.	Pompeian Red (reduced.)	Pompeian Red, permanent.
Homerton Red.	Homerton Red.	Maroon Brown.
Homerton Green.	Yellow Bronze Green.	Homerton Green.
Verona Blue.	Verona Blue (reduced).	Verona Blue (further reduced.

CHAPTER XXV.

Further Hints on Choosing Colour Harmonies.

Whether the decorator arranges his colours by rules or by customary practice or by systematised advice of experts, there remains for him that subtle discrimination between very similar tints and tones of colour upon the exercise of which the success of every colour-scheme very largely depends. It has been truly said elsewhere within these pages that no matter what ingenuity is employed in finding names for colours, nor how carefully colour-sheets may be prepared, in the last resort the human element comes in wherever colour is to be used. The best result in the use of an assortment of colours may thus be either secured or missed according to whether their characters in relation to one another are understood or misjudged or left unregarded.

It has often happened that colours, thought to be perfect for the positions assigned to them, somehow do not look right when placed and in use. Instances could be given where a colour has looked right when put upon a wall and seen by itself, but looked different when the assortment was completed. There is a play of one colour upon another, and observation shows that no colour can be correctly judged apart from others that come near to it. Though this is really a deep study with something like a scientific basis which has never been completely formulated, an attempt is made in this chapter to explain its main features and to open the way at least towards a more complete mastery of the subject for those who will follow it up.

Reflected Light.

Colours are recognised by means of reflected light, different surfaces reflecting differently in this respect and so enabling us to say that different surfaces have different colours. For the present purpose the only light dealt with will be daylight, the more or less diffused direct light of the sun. When this light strikes an object a part of the light is absorbed and the rest is reflected. The complete light may be termed white light or whole light. The reflected portion of light is therefore partial, or incomplete light, and is called coloured light, being quite distinct from semi-darkness or twilight, which comes from insufficiency of whole light.

Surfaces from which incomplete or coloured light is reflected are said to be coloured surfaces, and the objects upon which they exist are said to be coloured objects. An apple may be called a red apple because it reflects that part of whole light which is red coloured light. Pigments are employed to produce surfaces reflecting these partial or coloured lights and it is in respect of this property that they are selected and arranged to produce decorative effects in patterns and spaces.

Prismatic Colours.

When direct sunlight falls upon a prismatic lens, the light is passed on divided into its component parts, giving the series recognised as the rainbow colours. Theoretically if these coloured rays could be put together again, the result would be a perfect or white light, because the whole of the light remains, though in new form. But it does not follow that a set of pigments presenting the same colours would, if mixed together, produce a surface reflecting white. A more correct application of the theory would point to such a mixture producing black, because, as has been said, a coloured surface gives its effect of colour by absorbing parts of the light which falls upon it and reflecting only the rest. It has been claimed

by some makers that owing to the purity of their pigments, it is possible by mixing them in certain proportions to produce a perfect black. But then a question may arise as to what constitutes a perfect black, and experiment will show that what may be taken for black, when surrounded with brown or yellow, takes on a rusty appearance when flanked with dark purple blue. In practice, a mixture of pigments of all the rainbow colours produces a grey, inclining towards the tint of any pigment that is present in excess of the rest. No attempt to produce, by a mixture of pigments or by any other means, a pigment which will do duty as a satisfactory black in all circumstances, is at all likely to be successful.

Study of the rainbow or prismatic colours shows them to constitute a series having three culminating points, red, yellow and blue, between which lie an indefinable range of colours formed by the mingling or overlapping of these principal colours. Because each principal colour stands by itself and cannot be produced by any mixture of colours it is called a primary colour; and colours that lie between any two of them in the rainbow, each being compounded of two primaries, are called secondary colours.

Tertiary Colours.

When the third primary colour is added to a secondary colour, a new order of colour is produced which is called "tertiary," and it is this order or range of colours that accounts for the greatest part of the decorator's work. Tertiary colours contain all the three primary colours in varying proportions, and are sometimes called "broken" or "dull" or "reduced" by comparison with the primary and secondary colours, which are then recognised as "pure." The justification for the use of these terms lies in the fact that the pure colours contain no black, which is the negation of colour and of light, all tertiary colours being directly related to black and to grey which may, in fact, be included within their range.

To effect the harmonious assortment of colours it is necessary to remember the effect that each colour has upon those that are seen near it or in succession to it. This is not in any way due to any actual change coming upon the coloured surfaces and is even independent of any diffused reflection of coloured light from one coloured surface to another. It is, in fact, due to retention of colour impressions within the eye, and to some slowness in the brain to receive the new colour impression or to comprehend the colour presented. For instance, if a bright green surface has the eye turned towards it after inspection of some very different colour, say red, there is a sensation akin to surprise, and the thought that this is a remarkably definite green. It is at first estimated to be a much greener surface than it would have been thought to be if seen elsewhere. The cause of this phenomenon must be sought for in a study of the organs of sight, and is more a matter of optics or of psychology than of decoration, but its effect upon the arrangement of colours may be accepted and acted upon.

In the instance quoted, the green appears more green, and at the same time the red appears more red than when seen elsewhere, and from this instance the effect of any colour upon another may be judged of. They appear to differ most when side by side, and the more they differ elsewhere, the greater will be the changes brought about by proximity. Even where two colours are very much alike there will be more apparent difference when they are seen together than when seen apart. The phenomenon is called an instance of the law of contrast, which holds good in matters other than colour. For instance, a tall man walking beside a short man looks taller, and the short man looks shorter than when they were seen alone.

But as this law of contrast is constant and must be reckoned with, it is well that a key to its action in matters of colour is easy to acquire. The subject is dealt with at considerable length in "The Decoration and Renovation

of the Home," but the following brief account of the study may be useful.

THE CHROMATIC CIRCLE.

If a complete series of rainbow colours is arranged as a chromatic circle, with equal and equidistant segmental spaces for each primary colour and as many equal intermediate segments as may be decided upon for secondary colours, it will be found that every colour has its opposite or complementary lying on the other side of the circle. It is always this opposite or complementary that appears to be thrown by a colour upon any that is seen beside it. Thus, in the instance cited above, the green throws red upon red and increases its redness, while the red throws green upon the green and increases its greenness. If green comes beside blue, by the same rule the blue throws orange upon the green, making it appear to contain more yellow than before, while the green throws red upon the blue, making it incline toward violet.

The chromatic circle thus arranged shows only pure colours, namely, the primary and the secondary colours. But the tertiary colours also may be dealt with in the same manner, the law of contrast applying to all variations of tone or intensity between different colours or between tones of one colour. The study of colour, based upon the chromatic circle, not only provides a reliable guide to the selection of pure colours that contrast well with one another, but points the way also to the selection of the tertiary colours which are so much more frequently required. It shows which colours when brought together will improve one another and so make what is called a good contrast, and also those which will empoverish one another and so produce an assortment that is often unsatisfactory though not always without its uses. Instances of good contrasts have been given. An instance of empoverishment is supplied if blue comes beside purple, where the blue throws orange upon the purple, inclining it to grey, and the purple throws pure

yellow upon the blue, turning it towards green. In the one case a secondary colour becomes a tertiary, and in the other a primary becomes a secondary, deterioration being apparent in both colours.

Whether a good or strong contrast is desirable or not, in any particular instance, is a matter to be determined in accordance with the circumstances of the case. It is obviously useful that a railway signal should be brightened with the most definitely contrasting colours that can be found. Signal red, white and black are visible at the greatest distance, partly perhaps because they are so easily picked out by the eye from their usual setting of natural colours or sombre buildings. A naval flag must also have strongly contrasting colours, such as red, green or blue upon white, or a white shape upon a blue ground, or any other arrangement that will quickly catch the eye, even at a great distance.

But the decorator has no such call upon his skill, and has no need for that degree of contrast in the ordinary course of his work. Though one of the chief uses of colour is to secure clear delineation of form he can do well enough in his own sphere by the use of those less definite contrasts that are suited to positions easily and constantly seen, and which should be a continual source of pleasure and comfort. It is thus that he deals less with primary colours than with the compound colours, namely, the pure secondary colours and the broken, dull, tertiary colours, and particularly the latter, which are generally quite bright enough for the purposes he has in view, when properly arranged.

Compound Colours.

There is a very definite reason for the fact that these compound colours are usually more pleasing in domestic decorative work than the pure primary colours can be. Colour in decorative work is not the unfettered caprice of an amateur, nor the mere whim of any owner who may be in a position to pay for a fancy, however foolish. There are definite services to be performed by colour, and the

decorator who ignores them is hardly treating his craft with adequate respect.

Wealth of colouring will give richness of appearance where it is desired, variety of colours will brighten a dull and sunless room, and another type of colouring will moderate a glare of light. Suitable selections must be thought out for each room or part of a house, and in particular the amount of contrast between different parts of a colour scheme must be determined by the result aimed at. It is usually desirable to have some bond of union between the colours put into a decorative scheme, by which the sight may pass easily and comfortably from one part to another. Shocks and jars to the sensitive visual organs, given by any excessive contrasts, may cause annoyance and fatigue, and therefore lead to condemnation of the scheme as being in bad taste, or for some other reason at least undesirable.

The range of colours that may safely be used in an assortment is wide enough, and the lines upon which a selection should be made are easily followed, when once the the composition of colours, as apart from the mixing of pigments, is thoroughly understood. It is in this way that harmony of colours may be arranged, colour harmonies being called harmonies of contrast when those colours are used that differ widely, and harmonies of analogy when they are more closely in agreement.

Harmony of Contrasts.

As an instance of an assortment of colours united in harmony of contrast, the following may be mentioned—cream brown, sage green and dark terra cotta, yellow being present in each colour and forming a bond of union throughout. A similar set of colours may be selected by the names given in Windsor and Newton's sheet, namely, raw sienna, Indian red, oxide of chromium, and a cream. If the green or oxide of chromium were omitted or replaced by the light red in the colour sheet, the assortment might be called a harmony of analogy. Upon

a similar basis any number of agreeable assortments may be worked out, and it is also obvious that some may be put together from the same colour sheet that would hardly satisfy except for particular purposes and when specially treated. As an instance of what may be done to reconcile very different colours, an extreme case may be taken from the colour sheet, namely, Crimson, Permanent Green, Permanent Blue and Yellow Ochre. If these colours had to be used as they are in parts of a decorative scheme, they could be brought, to some extent, into agreement by the use of another colour, made by mixing small portions of each and using it to form borders or plain spaces between the different colours. The mixture should be made of such proportions as would produce a grey or brown, with some white stirred in, if necessary. An even better result could be obtained with these pigments if a small proportion of the mixture were added to each colour. The improvement to be gained in this way may be gauged by the appearance of an assortment of colours when viewed through a coloured glass, which then adds something of its own colour to each of the colours in the assortment and brings them into more definite agreement. If any doubt exists upon the matter, an opportunity may be found for inspecting an oil painting before and after it is varnished. The varnish adds a little golden brown to every colour in the picture, and the improvement that results is due to the bond of union so provided. As the picture gets older and the colour of the varnish deepens, the bond of union becomes more definite and the colouring is more highly esteemed, up to the point where the differences of the various colours are too much obscured, when cleaning and re-varnishing are found to be desirable.

When a set of colours has to be selected for the decoration of a room in an ordinary house, the difficulty usually lies in the wideness of the choice that may be made. Where there is already something to go upon, as, for instance, the colours of carpet or curtains already

selected, much of the difficulty disappears. Indeed it may often be best dealt with by the simple expedient of following the colours used in the woven fabrics, with certain modifications. If a wall paper is to be used, it should have a total colouring that will provide some contrast with the curtains and more with the carpet. If either the carpet or the curtains has a single colour throughout, there may be plenty of variety in the colours of the wall paper. But it is always best to have one or the other of a plain colour, or something very near to it.

Patterns in all parts of the room are generally a mistake, however well their colours are arranged.

The Decorator and the Upholsterer.

When the decorator is entirely free of any such guidance, he has an opportunity of suggesting a set of colours for the walls and ceiling, to which the upholsterer will have to conform when his turn comes. The colours for the walls, woodwork and ceiling have then to be selected, and it is not always an easy matter for the decorator to put forward a scheme of colouring that will secure approval and give permanent satisfaction.

As the colours of paint are easily adjusted and a wallpaper must be taken as it is shown, it is prudent to get the wallpaper chosen first, and fortunate for the decorator if he is left to do what he thinks best as to the colours of the painted work. But he must know what colours will do well together, and the following sets of colours are suggested as some that should answer the purpose.

Colouring Ceilings.

As a general guide, it may be said that the usual practice of painting or distempering the ceiling white has much to commend it. No colour will diffuse light quite so well, either in daytime or by artificial light. It is, however, very often desirable to tint the ceiling in a way that reduces the otherwise strong contrast between

white and the total colour of the wallpaper, and so provide a bond of union between the two that will render their effect more agreeable. Whatever is put upon the ceiling will always appear slightly nearer to grey than if it were put upon the wall ; and so in order to counteract this, it is well to use a little yellow in the ceiling colour, just enough to give the white a slight tint in the right direction.

It is usual to treat the cornice and frieze in the same way as the ceiling, and it has the advantage of increasing the apparent size of the room to do so. As the cornice may catch more light than the ceiling, it may often be desirable to use a rather deeper tint of the same paint for it, though it is by no means always necessary. If there is a frieze, the treatment of it with the ceiling will generally do all that can be done to "put out" a rather useless feature.

The wall may usually be dealt with by the selection of a paper or of a plain or scumbled colour. If the decorator has anyone to please he may have to submit a great many patterns of paper or work, for it is a noticeable fact that people will devote more attention to the selection of a wallpaper than of anything else in the room, and yet will often spend less money upon it than upon a hearthrug or even a single sofa cushion. But the decorator must take such customers as they are, and be patient while they choose the wallpaper, knowing that the ten times more important business of the painted woodwork will follow almost as a matter of course, and with little comment, if any.

When the treatment of the walls is decided upon, the woodwork should be done in one or more colours that will do honour to the walls. If there is a wallpaper of pronounced design and strong colours, the woodwork must be of deeper tone or of a much lighter tint than the total colouring of the paper. The woodwork is a framing or setting for the wallpaper, and the more pronounced the colouring of the paper, the more distinct must be the colour of the woodwork. For instance, if the wallpaper

is of an orange ground with natural green foliage, purple and white flowers and a grey blue bird with a bright red head and yellow beak, then the paintwork may be of a very dark brown or peacock blue.

If the walls are in two tints of stone colour, the woodwork may be pure white or light green.

If the walls are in two tones of blue, the woodwork may be of a darker blue or a dull red.

If the walls have a red damask paper, the woodwork is often done in white enamel, though this is generally too strong a contrast, and a better effect is obtained by a light brown or ivory in two tints.

If the walls have a paper containing much light green upon a white ground, the woodwork looks well in two greys.

If the walls are done in light leather or vellum colours, the woodwork looks well in a darker tint of the same colour if one small member can be put in with blue.

Almost any plain coloured wall looks well with cream colour or stone colour on the woodwork, the one fault to avoid being too much contrast.

When doubt exists as to what will look well upon the woodwork, the safest line to take is to paint it in a wood colour, as it cannot look wrong then. One of the many oak or walnut colours will be the safest choice, mahogany being always rather risky, except upon a door with all the rest of the woodwork white or nearly so.

CHAPTER XXVI.

Recipes, Cleaning Paint and Miscellaneous.

As explained in a previous chapter, it is impossible to give exact proportions of materials necessary to produce a paint that will suit every job. These proportions are determined by the condition of the work. A new door of good sound pine will be treated differently to one made of an inferior wood, which is knotty and somewhat sappy. Again, a door that has been exposed to the weather for some years, and from which the paint has, perhaps, almost wholly departed, will require a different mixture to a front door from which the accumulation of old paint, extending perhaps, to over one hundred years, has been burnt off. Precisely in the same way as patent medicines cannot be safely used for any and every complaint, so it is impossible to have paints that will suit any and every purpose. In one case the doctor is consulted and he takes into consideration every symptom and every condition and acts upon his diagnosis or scrutiny of symptoms. In like manner the decorator takes note of every condition of his work, and prepares his paint accordingly. Again, iron would not be painted with the same mixture as wood. Still, if we cannot give *exact* proportions, we can, at least, give some information on the subject, which will form a guide and give some data for the reader to work upon. These we will give under separate heads.

PRIMING FOR IRON.—The usual plan is to use red lead mixed with linseed oil, the proportion required being about fourteen pounds of linseed oil to every hundredweight of lead. The second coat should be equal proportions of red and white lead mixed to a proper consistency with linseed oil. Sometimes oxide of iron paint is used instead of red lead.

PAINTING ON STUCCO.—The priming must contain a considerable quantity of oil because of the absorbent nature of the stucco, and it should have a big proportion also of turpentine. Four gallons of boiled oil to a hundredweight of red lead and three quarts of turpentine will usually answer. The second coat should be an equal mixture of red and white lead with a smaller proportion of turpentine and oil.

PRIMING FOR DEAL OR PINE (INSIDE).—With white lead use three-quarter ounces of driers and the same quantity of red lead to every pound of lead. Thin with three-quarter gallon of raw linseed oil to 14 lb. of lead.

SECOND COAT (INSIDE).—Use about half an ounce of driers and one ounce of red lead to every pound of white lead; 14 lb. of lead will require half gallon raw linseed oil and quarter gallon turpentine.

SECOND COAT (OUTSIDE).—Use about one ounce of patent driers to every pound of white lead, with the addition of about the same quantity of red lead.

THIRD COAT.—Use to 14 lb. of lead, quarter gallon each of raw linseed oil and turpentine and quarter pound driers.

TABLE OF MATERIALS REQUIRED.

The following table is extracted from a more elaborate one to be found in the "Painters' Pocket Book," by A. S. Jennings, published at 5s. nett by The Trade Papers Publishing Co., Ltd., 301, Bank Chambers, 329, High Holborn, W.C.1.

On absorbent surface, such as new plaster and stone. Based on the assumption that 10 lb. of white

lead mixed with driers and thinners will cover 40 square yards.

Sq. yd.	White Lead. cwt.	qr.	lb	Patent Driers. lb.	oz.	Linseed Oil. gal.	qt.	pt.	gil.	Turpentine. gal.	qt.	pt.	gi.
5			1¼		2¼				1¼				¼
10			2½		4¼				2½				½
20			5		8½			1	0¼				1¼
50			12½	1	5¾		1	0	3¾				3¼
100			25	2	11½		2	1	0¼			1	2½
500	1	0	13	13	8¾	3	2	1	0¼		3	0	1½
1000	2	0	26	27	1½	7	1	0	1½	1	2	0	2¼

TABLE : When 10 lb. of white lead with driers and thinners will cover 60 square yards (as on old painted work, or after second coat on new work).

Sq. yd.	White Lead. cwt.	qr.	lb.	oz.	Patent Driers. lb.	oz.	Linseed Oil. gal.	qt.	pt.	gil.	Turpentine. qt.	pt.	gil.
5				13¾		1¼				½			¼
10			1	10½		2½				¾			½
20			3	5¼		4¾				1¾			¾
50			8	5¼		12			1	0½			1¼
100			16	10½	1	8		1	0	1¾			2½
500		2	27	5¼	7	2¼	1	1	1	3½	1	0	3¼
1000	1	1	26	10½	14	4½	2	3	1	3	2	1	3¼

EGGSHELL GLOSS.—To every pound of white lead add quarter of an ounce of copal varnish and to same quantity of gold size with half the quantity of boiled oil. These will serve the purpose of binding the materials together and causing them to dry. The thinners should consist of turpentine used in the proportion of about three-quarters of a pint to every 7 lb. of white lead.

OXIDE OF ZINC.—In mixing oxide of zinc it is necessary, as already mentioned, to use a special drier free from lead. Special zinc driers may be purchased ready made. They consist for the most part of borate of manganese.

OUTSIDE WOODWORK.—To every hundredweight (112 lb.) of zinc oxide ground in oil as usually supplied use 19 lb. of refined boiled linseed oil, 5½ lb. of turpentine, and 5 lb. of zinc driers. A smaller quantity of driers will frequently suffice.

INSIDE WOODWORK.—Use rather more refined boiled oil and a little more driers.

These mixtures may be employed in varying proportions of oil and driers on stone, plaster and iron, and the quantity of turpentine will rarely require to be changed.

SOME PRACTICAL RECIPES.

OUTSIDE ZINC WHITE.

100 lbs. zinc oxide.
30 ,, white lead.
20 ,, floated silica.
5 gal. raw linseed oil.
Grind and add—
5 gal. raw linseed oil.
3 ,, 1 pint white spirit.
1 ,, 3 pints liquid drier.

STANDARD WHITE (STRICTLY PURE).

66 lbs. white lead.
34 ,, zinc oxide.
2 gal. raw linseed oil.
Grind and add—
7 quarts raw linseed oil.
2½ pints white liquid drier.

ENAMELS.

EXTERIOR WHITE ENAMEL.

15 lbs. zinc oxide.
10 ,, lithopone.
½ gal. bleached linseed oil.
½ ,, pale body varnish.
1 pint turpentine.
Grind and add—
3 gals. white copal varnish.
3 quarts turpentine.

White Enamel (Elastic and Durable).

32 lbs. "Green Seal" zinc oxide.
¼ oz. Cobalt ultramarine blue.
½ gal. Poppy oil.
1¼ gals. white marble copal varnish.
Grind and add—
5 pints camphorated turpentine (1 oz. camphor to gal.).

Camphorated turpentine is made by dissolving 1 ounce of camphor gum in one gallon of turpentine.

"Heavy Camphor turpentine" is made by dissolving 2 lbs. of camphor gum in one gallon of turpentine. Camphor reduces the brittleness of the hard varnish gums.

Paste Wood Filler (White) "A."

150 lbs. floated silica.
27 ,, raw linseed oil.
4 ,, Japan.
18 ,, turpentine.

Paste Wood Filler (White) "B."

150 lbs. floated silica.
27½ lbs. boiled linseed oil.
22¾ ,, crystal drier.

Paste Wood Filler (White) "C."

150 lbs. floated silica.
50 ,, terra alba.
23¼ ,, raw linseed oil.
7¾ ,, white grinding Japan.
21½ ,, turpentine.

Paste Wood Filler (White) "D."

150 lbs. floated silica.
30 ,, plaster of Paris (common).
15 ,, rye flour.
23¼ ,, raw linseed oil.
14½ ,, best liquid drier.
12¼ ,, white spirit.

A Selection from the

B.E.S.A. Proposed Standard Shades for Prepared Paints.

PLATE XIV.

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(*Plates Prepared by The Mitchell Colourcard Company*).

IRON FILLER.

30 lbs. floated silica.
15 ,, gilders' bolted whiting.
2 ,, rye flour.
4 ,, bone black.
Grind in—
7¾ gal. boiled linseed oil.
7¾ ,, Japan common grinding.

CLEANING PAINT AND VARNISH.

It is rather curious to note that the operation of thoroughly cleaning old painted and varnished work is done very imperfectly in a number of cases, particularly what is known as cheap work. As a matter of fact, the cleaning operation, if properly and thoroughly done, may and often does mean, that it is discovered that the work is in such a good condition that it can be left as it is without any paint whatever, and it was only an accumulation of dirt on the surface that rendered it shabby. This is particularly the case in London and other large towns where the accumulation of soot on the surface of painted work goes on all the time and quickly destroys the appearance of the stone colour so much used in the metropolis. If anyone has doubts as to the amount of soot that can be deposited in a London atmosphere let him try a simple experiment. Paint a board white or cream colour, and place it in some position on the roof where it will lay flat for a year; at the end of that time it will probably be found to be quite black. A curious thing about this, however, and one which upsets one's theories to a great extent, is that if several boards painted with paints of different compositions are experimented with in this way, the paint on the board which is dirtiest will be found in the best condition after the dirt has been washed off, there being a certain amount of acid. One would imagine that this would adversely affect the paint itself. Such, however, is not the case. Possibly the rain washes out acid as it becomes deposited, but the fact remains.

Most old painted surfaces are dirty, and more or less greasy, particularly in the case of a door, near the handle. It is necessary to remove every particle of the grease and dirt or the paint will not dry properly. The best material to use for the purpose is what is known as sugar soap or painters' soap, which is supplied in powdered form and is very strong and effective. Manger's Improved Sugar Soap is an excellent article for this purpose, and it may be used also for stripping paint work and varnished papers.

The next best thing is ordinary washing soda, and this may be used in varying degrees of strength according to the character of the work and how far it is dirty and greasy. The maximum strength should be 10 per cent. solution which should never be exceeded. As a gallon of pure water weighs 10 pounds this means that one pound of washing soda must be added and this should never be exceeded. In fact, this mixture will, if left on too long, soften the paint to some extent. For ordinary work one may say that from half to three-quarters of a pound to the gallon will suffice, with a 10 per cent. solution for unusually dirty work. The surface should be well wetted, the brush used vigorously, and care taken to wash over the surface with clean water and a sponge when the dirt has been removed. This is in order to get rid of all the soda which may remain on the surface and which would adversely affect the paint if allowed to remain.

The above remarks refer to the object that is to be repainted. For ordinary white paint that has become soiled, a little whiting and water will be found quite effective. Mr. John Elliot, the head teacher of the House Painters' and Decorators' Class at the Edinburgh College of Art, recommends the following process for cleaning a paintedwall :—

Soap powder of any kind will not do, but dissolved soap will. Cut a pound of ordinary soap into small shreds, and dissolve it in one gallon of boiling water. It may require boiling for a short time in order to fully

melt all the shreds. Let it cool, and then it is ready for use. If you are cleaning a room, the walls of which have been well painted, and will be as good as ever if they are properly washed, proceed in this way. Take one wall at a time, but before putting any soap on the wall to be washed, wet with clean water about a foot outwards from the corner, each of the adjoining walls. This will prevent their being marked by any spot of soap which may fall on them. With a flat brush begin to lay over the wall to be washed with the soap, beginning at the bottom and working upwards to the top. Cut down each corner carefully. After the wall is laid over, wet a piece of soft floorcloth with the soap, and rub over the whole surface regularly. Try a piece of the wall with a sponge and clean water. If it is clean enough, wash off with a broad brush, using plenty of water, and allow it to dry without the aid of either sponge or skin. Perhaps parts of the wall may be extra dirty, and marks may be difficult to remove. In that case take a little ground bathbrick on the wet floorcloth and rub the dirty parts, taking care that you gradually diminish the rubbing as you proceed outward from the dirty place, otherwise you will make a mark which will spoil your wall. This is, to my mind, the best method of washing paint; only it requires great care, and when properly done leaves nothing to be desired.

Gloss Paint.—This is a variety of paint which is mixed with Varnish in order to produce an extra glossy surface. Until a few years ago the average gloss paint was not of a very superior quality, but now there are many hard gloss paints made, which are not only much better in appearance to the ordinary quality, but are much more durable. This is due to the fact that in the manufacture a certain amount of varnish, made from hard resinous gums, is introduced, with the object of strengthening the linseed oil content.

It is probable that this class of paint will increase considerably in use during the next few years, and it will

be obvious that the introduction of the varnish gums serve to strengthen the paint, and produces a result much superior to that which is obtained when a quantity of varnish is added to a paint when mixing. The reason is that the manufacturers know precisely what kind of varnish to use, and vary this somewhat according to the particular pigment which is used in the paint.

Removing Paint.—When paint is blistered or cracked it is usually necessary to remove it down to the wood, iron, or other surface to which it has been applied, and this may be done either by means of a burning-off torch or by means of the application of a solvent.

Speaking generally, the burning-off process will be the cheaper and most suitable for outside work, as the fumes which are generated by the burning will not be objectionable. In interior work, however, the use of a solvent is often preferred as there are, of course, no fumes.

Paint solvents, or as they are frequently called "Paint Removers," are of two distinct kinds, one being composed of a mixture of ordinary soda and lime, and in some cases other constituents, and a second class, which is a spirituous mixture. When the former is employed it is necessary, after the paint has been softened and scraped off, to apply a coat of vinegar and water in order to neutralize the alkali, but when the spirituous mixture is employed, this is unnecessary, and all that is required is to wipe the surface over with a piece of rag soaked in turpentine, or a little of the "paint remover." A final rubbing down with fine sandpaper will produce a surface fit for painting on, after the necessary stopping of cracks, nail holes, etc., has been attended to.

The following are a few recipes for removing old paint, which are included for the sake of completion, but in most cases it will be found cheaper to buy the paint remover ready made:—

One of the best solvents of paint is benzol and acetone or fusel oil. About equal parts of the benzol and acetone can be used with a little paraffin or other wax, the object

of this being to prevent rapid evaporation. Another recipe is benzol 8 parts, acetone 6 parts, methylated spirits 2 parts. For an alkali solvent use equal parts of slaked lime, soda and ammonia, which will form an effective paint softener.

PAINT SPRAYING.

The paint mixer will be interested in knowing that the application of paint by means of compressed air is rapidly increasing in popularity and will, in course of time, doubtless be used for all large surfaces. The old-fashioned painter may scorn the idea of paint being applied by any other means than a brush, but when he is informed that paint spraying is used in over 100 different industries, and in house painting in America and Canada, he will realise that the method has long ago passed the experimental stage.

It has been proved that a film of paint, when sprayed on by a competent operator, is more uniform in thickness than one which is put on with a brush. The reason is that in the latter case, there is more pressure on the middle of the brush than there is at the side, and hence, the film of paint is thicker in some places than in another, even when the most expert brush hand does the work. If there is any doubt of this, a simple experiment can be made, which will demonstrate its truth. Take two sheets of white celluloid and cover both with paint, one with a spray and the other with a brush, then hang the two in front of an electric light and the difference will at once be apparent.

It is sometimes thought that paint sprayed on has a tendency to crack or peel off, but if this occurs, it is nothing to do with the spraying, the cause is that either the paint is not properly mixed or the surface to which it is applied is not in proper condition to receive it. It may be too hard and glossy, and it may be damp, or other reasons may cause the peeling, but it can be taken as a solid fact that if the peeling occurs, it would occur equally

whether the paint was put on with a brush or spray, the conditions, of course, being the same in each case.

There are several different paint sprayers on the market, the Aerograph being one of the oldest and best. It consists of an air compressor and a paint pot, connected with two hose, which terminate in a "pistol," the pressure of air is usually obtained by a small motor, which may range from 20 to 60 lbs. per square inch. The paint is under sufficient pressure to cause it to be forced out of the machine. When the lever of the pistol is depressed, the paint and air are discharged at the same time. The latter atomizes the former, which is projected on to the work at a speed which may be taken to be approximately five times as fast as can be done by hand. Almost any paint can be sprayed up to a consistency of thick tar.

In carrying out painting of an ordinary room: ceilings, walls, etc., can be done without difficulty, and to keep the paint sprayed on to the door from coming over on the walls, a piece of compo board or tin is held close up to the frame and upon this the outside edge of the spray rests. Moulding, sash bars, etc., are just put in with a brush by hand.

The subject of paint spraying is dealt with at length in "Painting by Immersion and by Compressed Air," by A. S. Jennings, published at 7s. 6d. by The Trade Papers Publishing Company, Ltd., 301, Bank Chambers, 329, High Holborn, London, W.C.1.

NITRO-CELLULOSE FINISHES.

Although not strictly included within the subject of this book, it is felt that a short description of these new products would be interesting. They have come into use only during the last year or so, and it can be safely averred that their manufacture has by no means been perfected; in other words, there is a great deal of work to be done before they are likely to supplant oil varnishes.

Cellulose varnishes or enamels are being used for motor-cars, metal and other work, with a measure of

success, and in course of time will be much more largely employed than they are at present. The points in their favour may be thus summarised: they dry very quickly by evaporation, therefore several coats can be put on in one day; in fact, one coat can follow another in the course of an hour or even less. The surface is very hard, is uneffected by acid, alkali, petrol or oil. It can be polished to the degree of a piano finish, if required, but is frequently left in semi-gloss which can be polished up as required. Thus far they cannot be applied by means of a brush but must be sprayed on by a machine with the aid of compressed air. Efforts are now being made to produce a finish which can be put on with a brush, and if this succeeds there will be a valuable adjunct to the painter's list of materials, particularly as they dry so hard as to resist abrasion.

THE CARE OF BRUSHES.—However good a brush may be it will soon be ruined unless it is properly treated when out of use. The following hints will suffice as a guide in this respect:—

Writing Pencils, etc.—Wash in turpentine until quite clean, and if they are not to be used for some time, dip in olive oil and smooth from heel to point.

Stipplers.—Wash thoroughly in pure soap and hot water, rinsing with cold water. Place point downward to dry.

Varnish Brushes.—The best method of keeping varnish brushes, in the opinion of the author, is to suspend them in the same description of varnish as that they are used for. As this is not always possible, boiled oil may be used instead.

Paint Brushes.—Mr. Ernest N. Kent gives the following instructions in "Specifications":—

Brushes made for Use in Colour should first be soaked well in water to swell the bristle in the binding. This applies also to whitewash brushes which are bound either by wire or leather.

A Brush after use should be thoroughly cleansed out in turps or soap and water. If left in water any length of time they are liable to twist, and the bristles lose their elasticity.

A Brush made for Paint should not be used in varnish, the spirit of which dissolves the cement with which it is set, and loosens the bristles. When a ground brush has been well worn down in colour, it may, however, be used in varnish.

Varnish Brushes when not in use should be suspended in either varnish or oil, the brush not resting on the bristles. No brushes should on any account be kept in turpentine.

Stippling Brushes should be well cleansed and dried after use, the bristle being carefully kept from crushing; a box in which they can be slid, allowing the bristle to hang downwards, is recommended.

Should a Brush become quite hard with Paint it should be soaked for twenty-four hours in raw linseed oil, after which time in hot turpentine.

Oxides.—The oxide of iron paints which are so useful and economical for the use of house painters depend to some extent for their durability upon the proportion of ferric oxide which they contain. Even more important is the fineness of the pigment and the colour or tone. The writer has examined some Indian reds and a special Turkey red made by the Derby-Oxide and Colour Co., Ltd., Rugeley, Staffs., which may be taken as typical oxides of a high quality.

CHAPTER XXVII.

Colour-Measuring Instruments.

The Tintometer.—Many attempts have been made to devise an instrument by which records of colours can be registered with accuracy. The nearest approach to success in this direction is the tintometer, which is described as an instrument for the accurate analysis of measuring and recording of all colours. It was an invention of Mr. J. W. Lovibond, of Salisbury, and is largely used not only by colour and dye manufacturers, but in many other industries. By its use a colour manufacturer can dispense with keeping a sample of every colour he makes. Provided that the customer possesses a Tintometer, and the colour manufacturer one also, it is the simplest matter for an order to be sent simply by quoting numbers which will ensure complete accuracy of shades. The instrument itself consists of a double tube, ending in an eye piece at one end, and in equal apertures for viewing the colour to be measured, and the standard glasses which are used as measures at the other end. These glasses are coloured in various degrees of intensity, and in even gradations ranging from almost white to strong colours in red, yellow and blue respectively. In the whole, 465 coloured glasses are supplied with the instrument, but it is so very rarely indeed that so large a number is required, and, as a rule, forty or fifty glasses or even many less, according to the accuracy with which one works, will answer all purposes. It will be understood that the colour which is to be measured or recorded is placed

on one side of the double tube, on the other side is put one, two or three glasses which are changed until a perfect match is obtained. A note of the numbers of the glasses thus records the matched colour. The instrument is a great success, and permits of the colour analysis of pigments in powder, or paste, of oils, varnishes and driers—these latter are examined in accurately graded vessels or cells made expressly for the purpose.

Fig. 44 shows the Tintometer adjusted for measuring the colour of opaque objects. Under one side upon

FIG. 44.—THE TINTOMETER.

the stand, is placed the sample to be measured for colour, and under the other side the tray of standard white powder for reflecting a beam of white light, which is then intercepted by standard glasses until a match is obtained. The numbers on the glasses are then recorded.

THE EASTMAN UNIVERSAL COLORIMETER.

The Eastman Universal Colorimeter is an instrument for the measurement and numerical specification of colour. It is universal, since it will measure the colour

of liquids and transparent or reflecting solids of every colour with equal facility. It is a colorimeter and not a spectrophotometer since it measures a colour in terms of its visual appearance and not by analysis of the light spectroscopically. With the Eastman Universal Colorimeter, the colour is matched synthetically so that two colours, which look alike to the unaided eye, will also read alike. The instrument is designed for use in the factory or laboratory where the measurement, comparison, or standardization of colours is required. It is particularly adapted to the measurement of the colours of fabrics, paper, oils, paints, inks, dyes and dyed materials, coloured glass or celluloid, food or dairy products, interior decorations, etc.

This colorimeter operates on the subtractive principle. The light from the sample is made to illuminate one half of the field of view in the eye-piece. The other half of the field is illuminated from a standard lamp by light which has been passed through dyed gelatine wedges. The wedges consist of thin layers of gelatine of increasing thickness from zero to a maximum. The gelatine contains a dye which will absorb, in varying amounts, one of the additive three-colour primaries. There are three of the coloured wedges, and, by changing their positions, any desired amount of each of the colour primaries may be subtracted from the white light. By using only two of the coloured wedges at a time, with a neutral gray wedge to match the brightness of the colour, it is possible to match every tint or shade of every colour, including the non-spectral colours, purple or magenta. The colour is then recorded by reading on the scale of the instrument the positions of the wedges necessary to produce the colour match. For every colour there is one and only one setting of the wedges which will produce a colour match. Likewise, there is a set of positions for every colour which occurs in the arts or industries. The only colours which cannot be matched are the monochromatic hues which are produced in a pure spectrum.

It should be understood that the precision with which a given setting of the wedges can be repeated is dependent upon the sensitivity of the eye to differences in hue, saturation, and brightness. The precision obtainable in colour measurement is limited only by the sensitivity of the observer's eye.

Any scheme for the specification of colour, except in the fundamental units, is necessarily arbitrary. The fundamental units are the hue (or the wave-length of the dominant hue), the saturation (or the percentage of white), and the brightness. These quantities can be measured with an instrument called a mono-chromatic analyzer which is a modified spectroscope. Such an instrument is very difficult to use and keep in adjustment, and is chiefly useful for standardizing other instruments. Unless calibrated, therefore, the scale on the Eastman Universal Colorimeter reads in arbitrary units of colour. It has one advantage over most arbitrary systems in that it is based on a decimal notation, the most saturated colour being given by a reading of 100. For many purposes, it is sufficient to record the positions of the wedges. However, to make it possible to refer to the fundamental physical nomenclature, the instrument may be calibrated and a table prepared converting scale readings directly into terms of hue, saturation and brightness.

The use of a set of samples for standardizing colours is unnecessary when this instrument is used. Instead, the reading of the scale is recorded when a colour match is secured and this colour can then be reproduced exactly at any future time. This cannot always be done with a sample of the material unless the colour is sufficiently permanent, and but very few colouring materials, such as pigment dyes, etc., are absolutely permanent. Even when the colour is permanent, it is not altogether satisfactory to standardize colours in this way.

Although the principal use of the Colorimeter is to match and record colours numerically, it can also be used to determine a colour which will harmonize with

any other colour. This is particularly useful for such work as selecting inks for printing on paper or fabrics of a given colour. In such cases, the sample of the material is placed in the instrument and the wedges are adjusted, not for a colour match, but for a colour which will harmonize with the colour of the sample.

The instrument is exceedingly simple to operate, and has a minimum of mechanical and optical parts that require care or adjustment. No difficulty in making the colour match will be experienced by anyone with normal colour vision who has had experience in matching colours. The manipulation is so simple that an in-

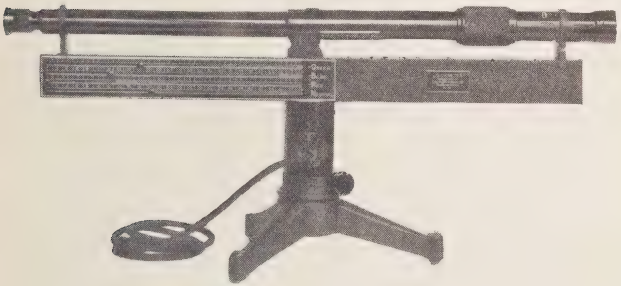

FIG. 45.—EASTMAN UNIVERSAL COLORIFIER.

experienced observer, with a little practice and study, can learn to make satisfactory measurements. The brightness of the field of view, and the fact that only two of the three coloured wedges need to be used at a time, make the setting for a colour match very rapid and precise. The instrument is built in the factory where the Kodak lenses are made and the parts are made with the greatest accuracy. It is very rugged in construction and is beautifully finished in a combination of black enamel and crystallized finish. The dyes used in the wedges are specially selected for their stability and will not fade under working conditions.

A reference standard lamp and attachment are furnished with the instrument. This lamp is carefully seasoned and calibrated with a specially-designed blue filter to give the same colour as noon sunlight. It is used only as often as necessary to standardize the lamps used in the Colorimeter as working standards. Used in this way, the reference standard lamp will remain constant for a long period. The lamps should be operated by a storage battery to provide a steady supply of current and a four cell, 100 ampere-hour automobile starting battery is recommended. The storage battery is not furnished with the instrument. The current through the lamps is controlled and measured by a control box which contains a Weston ammeter and the necessary rheostats. The control box is furnished as part of the regular equipment with the Colorimeter.

The Eastman Universal Colorimeter will measure the colour of walls or interior decorations without any attachments. Used without the attachments, the Colorimeter is a telescope and needs only to be focussed on the object whose colour it is desired to measure. It can be used in this way by illuminating engineers and interior decorators to measure the colour of the interior of theatres, etc. The instrument is also a portable photometer so that the intensity of the illumination can be measured as well as the colour of the decorations. For such purposes a rigid oak surveyors' tripod is provided to support the colorimeter.

The instrument is made by the Eastman Kodak Company, Rochester, N.Y., and the Kodak Co., Ltd., Kingsway, London, W.C.

CHAPTER XXVIII.

LIST OF WHITE, BLACK AND COLOURED PIGMENTS WITH THEIR PROPERTIES, PRINCIPAL USES, AND ALTERNATIVE NAMES.

ACADEMY BLUE.—A mixture of French ultramarine and viridian, ground only in oil and used by artists.

ALIZARIN COLOURS.—This group of pigments includes Alizarin blue, scarlet, crimson, rose madder, madder lake, burnt carmine, permanent crimson, yellow, violet, olive lake and sap green. Antracene is a coal tar derivative (C_{14} H_6O_2 $(OH)_2$. The best qualities are much superior in richness to similar colours made from the madder root, although in artists' water colours they do not, according to Winsor and Newton, "approach in beauty of colour those obtained from the genuine madder root." Alizarin colours may safely be mixed with burnt sienna, burnt umber, but not with pigments which contain iron. The colours are particularly useful to the house decorator when used as glazes over colours of less brilliant hue, but care must be taken to see that the ground is thoroughly dry before the glazing is proceeded with.

ALUMINA WHITE.—Aluminium hydrate, aluminium hydroxide, also called "Lake White" from the fact that it is so often employed as a base on which to precipitate lakes, etc. A soft and fine white which readily dissolves in all dilute acids as well as caustic soda.

AMERICAN VERMILION.—Another name for chrome red.

ANTWERP BLUE.—Prussian blue to which has been added a proportion of alumina in order to reduce the strength.

ASBESTINE.—A white powder made by grinding asbestos and used in small proportions in ready mixed and other paints with two objects, first to prevent settling of the pigments and, secondly, to ensure that when the paint film needs repainting, that it is somewhat rough and in a fit condition to receive another coat of paint without much preparation.

ASPHALTUM.—A bitumastic substance sometimes used both as an oil colour and in water. When mixed with colours it has a tendency to cause them to become grey. The best varieties are made from Trinidad asphaltum. Those made from coal tar pitch are particularly unreliable and are likely to bleed. To differentiate between the two, dissolve in genuine turpentine. If made of asphaltum the mixture will be an even brown, if from pitch a curdled mass with a greenish sheen. May be imitated by a mixture of burnt umber, raw sienna and ivory black.

AUREOLIN OR COBALT YELLOW.—An important artists' yellow, being a double nitrate of cobalt and potassium. Pure and bright in tone, is nearly permanent as a water colour. Discovered by Fischer and introduced by Winsor and Newton. Should not be mixed with lakes, indigo, etc. As it is very expensive, several cheaper substitutes are sold under the same name.

AURORA YELLOW.—A superior kind of cadmium yellow introduced by Winsor and Newton in 1889. It has a much denser body than ordinary cadmiums and is a better drier in oil. Its opacity and brilliancy are remarkable.

AZURE BLUE.—An artists' colour made from an admixture of zinc oxide and ultramarine. The name is sometimes given to cobalt blue.

AZURITE is called also air blue, bice, lime blue, blue virditer, copper blue, etc. It is a basic copper carbonate

and is useful as a stainer in distemper, being lime proof, but is unreliable as an oil paint.

BARYTES.—Heavy spur or natural barium sulphate. Although usually regarded by the house painter as an adulterant, particularly of white lead, barytes, as a matter of fact, is a very useful pigment used in paint making as (with the exception of strong sulphuric acid) it is unaffected by all acids and alkalies. It is often used in large quantities as a base of some of the para reds. When ground in oil by itself it possesses little or no body; if it did it would make an excellent paint. Being crystalline it feels somewhat gritty when rubbed between the forefinger and the thumb. This grittiness is apparent when barytes is added to white lead as it interferes to some extent with the smooth laying off of the paint.

BERLIN BLUE.—Another name for Prussian blue.

BISTRE.—A water colour of a brown colour, which is made from the soot obtained by burning beech and pine wood.

BITUMEN.—A colour is sold under this name which is similar to asphaltum (*q.v.*) but somewhat lighter in colour.

BLACK LEAD is the popular name of graphite (*q.v.*). It is not black, but nearer a dark blue in colour, and it does not contain a particle of lead.

BLANC FIXE is also called "Permanent White" and "Enamel White." It is an artificial form of barytes and consists of sulphate of barium, having excellent body. It is largely used as a base for lakes and some reds, is valuable as a finishing coat for paper which is to be polished. When mixed with oil it looses much of its opacity, but in water it forms a valuable pigment for many purposes.

BLUE BLACKS are of vegetable origin and are often made from vine twigs and other charred wood. When mixed with white a blueish grey is produced. Frankfort black, drop black, charcoal black and vine black are all similar products and all resist the action of acid.

They are deficient in body, but very strong in staining power. The composition is mainly carbon.

Blue Verditer, called also "Bremen blue," etc. A copper blue which has fairly good body in water, but little in oil. Sky blue in colour.

Bone Black.—A carbon black made by calcining bones.

Brown Madder, an artists' pigment made from the madder root and being distinguished for its permanency. Alizarine lakes are very often substituted for the madder product, but the latter are still made and are much esteemed by artists.

Brown Pink.—This is a fugitive lake pigment made from quercitron bark and is used in distemper work, especially in scene painting. It is really a yellow.

Brunswick Blue.—Prussian blue, to which has been added white to decrease its strength.

Brunswick Green.—This colour is usually a mixture of chrome yellow, Prussian blue and barytes, and is made in three or four different shades, namely, pale, middle, deep and extra deep. The proportion of barytes varies in different quantities, but almost always reaches 60 per cent. or over. These colours have a tendency to turn blue and cannot be regarded as permanent, although they are used to a very considerable extent. When the barytes is omitted, and Prussian blue and chrome yellow are mixed together, the pigment is called chrome green.

Burnt Carmine.—This is an artists' colour, made by charring cochineal carmine, which results in a deep purple colour, which is esteemed for its richness, although it is by no means permanent.

Burnt Roman Ochre.—A light red of special hue made by selecting special native earth and subjecting it to heat.

Burnt Sienna.—A very useful and comparatively inexpensive colour, semi-transparent and often used by grainers and for glazing. It is made by heating raw sienna and is of a rich brown colour. The finer grades are used by

artists, and the cheaper by house painters. It has much the same composition as ochre, viz., silica and alumina, but is richer in iron.

Burnt Umber.—Ordinary umber may be described as a variety of ochre, a native earth colour of a deep brown hue. Some varieties approach a violet brown. Burnt umber are those which have been produced by calcining. The raw article is useful in colour mixing for toning down. An average sample yields about equal quantities of silica and ferric oxide, with a large proportion of manganese.

Cadmium Yellow is the sulphide cadmium and is made in several different grades or shades, namely, extra pale, pale yellow, deep yellow, and orange. It cannot be used in admixture with white lead, emerald green, chrome yellow or any pigments containing lead or copper, but may safely be mixed with any other pigments. It could be used with advantage by decorators for high-class work to a much greater extent than it is at present, being a very beautiful shade of yellow.

Caledonian Brown.—This beautiful brown colour approximates umber, but has a somewhat richer hue. It is used principally by artists, and may be imitated by a mixture of umber sienna and vandyke brown or sienna and umber.

Cappah Brown.—This is another colour of the umber series and owes its peculiar richness to the presence of manganese in considerable quantity. Messrs. Winsor and Newton purchased all of the colour on the market some years ago. It may be imitated by using umber and burnt sienna or burnt sienna and vandyke brown.

Carbon Black.—This is one of the purest forms of black. It is manufactured from natural gas in America. It is of great strength and is absolutely permanent, but is a very poor dryer. It is sometimes called "Gas black."

Carmine Lake.—The carmine colours are brilliant crimson red, and are prepared from a madder root and

cochineal. The colouring matter thus obtained is precipitated on to a white basis, usually an alumina hydrate. These lakes are very fugitive colours and the alizarian lakes are now mostly employed in their place, although they are still used to a limited extent by artists, principally for glazing purposes.

CASSEL EARTH.—A variety of vandyke brown.

CERULEAN BLUE.—A variety of cobalt blue of a greenish blue hue; very permanent, of good body, principally used by artists, owing to its high cost.

CERUSE.—The French name for white lead.

CHARCOAL BLACK, sometimes called Charcoal Grey. In the manufacture of this colour soft woods are burnt, yielding carbon black, which is reduced with zinc oxide to produce this colour.

CHARLTON WHITE.—The original name of the pigment now generally known as lithopone. *q.v.*

CHINA CLAY is a white pigment sometimes used in the paint trade as a base in the manufacture of lake. It is a hydrated silicate of alumina and is distinguished from that fact that, unlike Whiting and Terra Alba, it is insoluble in dilute acid.

CHINESE BLUE is ferric ferrocyanide, may be described as an ordinary Prussian blue which has been produced with extra care. In the lump it has a characteristic bronze appearance which is sometimes thought to be an indication of inferiority, although, as a matter of fact, it is exactly the reverse.

CHINESE RED.—Another name for red chrome.

CHINESE WHITE.—A specially selected variety of zinc oxide prepared for artists' use. It is permanent and may be mixed with any other colour and is well adapted for use in oil and water. It has a better body than ordinary zinc ozide owing to its special treatment.

CHROME.—The lead chromes are named according to their tints and are known as light, middle and deep chrome, orange chrome and chrome red, American vermilion, etc. Primrose and lemon chromes are a

mixture of chromate and sulphate of lead. They keep their colour on exposure, have excellent body, but are affected by sulphuretted hydrogen and impure air. They may be mixed with most other pigments, but not with those which contain sulphur, such as ultramarine and cadmium yellow. Orange chrome was proved by a series of experiments made in America some years ago to be one of the best protective paints for iron and steel.

Chrome Green.—As remarked under the heading of "Brunswick green," this is a mixture of pure Prussian blue and chrome yellow, the proportions depending on the shade required. Sometimes zinc greens are added to increase the permanency of the colour. The name is occasionally applied to oxide of chromium.

Cinnabar.—A mineral of this name was formerly used in the manufacture of vermilion, but the latter pigment is now almost always made artificially.

Cinnabar Greens.—These greens are very similar in composition to the chrome green, but a deeper variety of chrome yellow is usually employed in their preparation.

Citron Yellow.—A variety of zinc chrome (*q.v.*).

Cobalt Blue.—This beautiful blue is made from alumina with oxide of cobalt. It is non-poisonous, absolutely permanent, and can be mixed with other pigments with safety. Its peculiarly fine tone renders the colour valuable for decoration, although it is somewhat expensive.

Cobalt Green is made from oxide of cobalt and zinc oxide, which yield a permanent semi-transparent colour of considerable beauty.

Cobalt Violet is described as being absolutely permanent, and to be unaffected by acid, alkalis or heat, while it is not discoloured by sulphuretted hydrogen. Being expensive, its use is almost confined to artists' work. It can be used for glazing, with advantage, by decorators in their best work.

Cobalt Yellow.—This is the same pigment as that described under the heading of Aureoline.

Cologne Earth.—This is another name for vandyke brown, which has been subjected to heat.

Constant White.—This is another name for blanc fixe or artificial sulphate of barium.

Cork Black.—As its name implies, this is a black made by burning cork chippings.

Cremnitz White.—This is a basic carbonate of lead made by a quick process.

Crimson Lake.—A beautiful rich red colour produced in the same way as carmine lake, but with larger proportions of alumina base. It is successfully used by artists for glazing. When employed over a solid red as a glaze, it is permanent, providing that it is protected by one or more coats of varnish.

Davy's Gray.—This is a new colour prepared by Messrs. Winsor and Newton, Ltd., from a special variety of slate suggested by Mr. Henry Davy; it is particularly recommended as a reducing agent, as it does not, like the blacks, sully the colours with which it is mixed, but gives pure and translucid effects and is a capital drier.

Dragons Blood.—A natural resin yielding a deep crimson colour, frequently used for colouring spirit varnishes a deep red.

Drop Black.—This term was formerly applied to ivory black ground very fine and yielding a very intense black, but not equal in this respect to gas black. The name was derived from the conical shaped drops, which the black assumed as it fell from the mill. Nowadays, drop black does not necessarily mean anything very definite, although it should be applied only to the best grade of pigment derived from vegetable matter.

Dutch Pink.—This is not really pink, but a yellow colour with a slight olive tone; it is much used by scene painters, as the hue is not effected much by artificial light. Dutch pink is very useful as a colour for distemper, and may be used also for glazing in oil colours.

Emerald Green.—This is aceto-arsenite of copper. A very poisonous material, containing, approximately,

copper oxide, 33 per cent.; arsenious oxide, 58 per cent It is very little used among house painters, but is still manufactured in large quantities for use as an insecticide In America it is known as "Paris green." Several non-poisonous greens, almost identical in appearance, are made, and these should be ordered either as "non-poisonous emerald green," or emerald green *tint* or of emerald green *shade;* the words "non-poisonous" being added to make it clear that the genuine article is not required.

Flake White is the first quality of white lead or basic carbonate of lead especially prepared for artists' use.

Foundation White.—An artists' white, cheaper than flake white, but of similar properties.

Frankfort Black.—The same as drop black.

French Blue.—The same as French ultramarine or artificial ultramarine.

Gallstone.—The same as yellow carmine.

Gamboge is a natural yellow resin and is usually sold in cylindrical rolls a little over an inch in diameter. It is a bright yellow colour, is useful for water colour painting, but gradually fades when exposed to the light. It is sometimes used in the manufacture of coloured varnishes.

Gas Black—The same as carbon black.

Geranium Lake.—A fairly permanent lake made from coal tar, which is very useful for glazing. It should not be mixed with the earth colours, such as sienna, ochre, etc., nor with chromes or white lead.

Golden Ochre.—A native earth similar to ordinary ochre, but of a brighter colour, which is sometimes produced by adulteration such as the addition of chrome yellow. It consists principally of silicate of alumina (clay) and iron hydroxide.

Graphite is a natural crystalline carbon pigment closely allied to the "black lead" used in pencils and for polishing stoves. Spec. gr. 1.19 to 2.5. It cannot be used by itself as a paint, because when ground in oil it

produces a very thin but not sufficiently protective coat. This results in it covering from 1,700 to 2,000 feet to the gallon. It is usually mixed with silica and sometimes with ferric oxide, when an excellent and very durable paint is produced, particularly suitable for application to iron and steel work.

GREEN EARTH.—An equivalent of terra verte.

GREEN LAKES.—These pigments have no very definite composition, being sometimes a combination of quercitron lake and Prussian blue, and at others zinc yellow, Prussian blue and alumina.

GREEN ULTRAMARINE.—A green pigment produced in a somewhat similar manner to artificial ultramarine blue.

GYPSUM is called also "terra alba," "mineral white," etc. It is a hydrated calcium sulphate. When it is fully calcined, and has no free lime in its composition, it may be used as a filler in paint, although it has but little body in oil. It can be mixed with any colour without being affected and is very permanent. Gypsum is sometimes used as the base of Venetian red in large proportions. In order to distinguish between chalk (carbonate of lime) and gypsum (sulphate of lime), treat with a weak hydrochloric acid. If an effervescence takes place the carbonate is indicated.

HOOKERS' GREEN.—An artists' water colour of considerable beauty, made from an admixture of Prussian blue and gamboge. In oil colours the hue can be approximated by using zinc yellow, yellow lake in cadmium yellow, with Prussian blue.

INDIAN PURPLE.—A semi-transparent water colour, made from either cochineal or madder-lake, with a base of copper. Messrs. Winsor and Newton state that for use in oil an excellent substitute for this fugitive pigment is now manufactured from madder-lake and French ultramarine.

INDIAN RED.—An improved pigment of the series of red oxides of which Venetian red, scarlet red, light

red and burnt sienna are derived. The composition is principally ferric oxide. Indian reds are of two distinct qualities: one derived from a natural mineral, and the other prepared artificially. The colours vary from a light red to a dark purple. They are nearly permanent, and may be used sparingly with white for producing flesh tints. Some very cheap paints are sold under this name.

INDIAN YELLOW.—This is an organic yellow pigment used by artists, and is made from puree derived from the urine of cows in India. It is not very permanent, and has given way to alizarone yellow lakes, upon which greater dependency as to durability can be placed.

INDIGO.—An intense dark blue made from various plants. It is not fast to light, is used more as a dye than a pigment, but in water painting can be mixed with reds and other colours to produce greys.

ITALIAN PINK.—A lake prepared from quercitron bark, used in water colour only.

IVORY BLACK.—An intense carbon black made by calcining chips of ivory. When mixed with white it gives a bluish grey. Much of the so-called ivory black on the market is merely an ordinary bone black.

KAOLIN.—Another name for China clay, *which see.*

KING'S YELLOW.—A colour formerly prepared from the mineral orpiment. It is extremely poisonous and the pigment now sold under this name is usually either a mixture of chrome yellow and zinc oxide in oil, or cadmium yellow and zinc oxide if prepared in water.

LAMP BLACK.—One of the most popular and cheapest blacks produced from a partial combustion of waste oils, fats, grease, etc., which yield a soot from which the lamp black is made. It may be mixed with any pigment; is unaffected by impure air, or acids or alkalis. When mixed with white it gives a brownish caste; when mixed with oil it dries very slowly and requires, therefore, the addition of a considerable quantity of dryers.

LEMON YELLOW.—A chrome yellow to which has been added in the process of manufacture a proportion

of lead sulphate. The name is also applied to preparations of chromate of barium.

Leitch's Blue.—This is a mixture of Prussian blue and cobalt which yield a peculiar bluish colour much esteemed.

Light Red.—This is one of the iron oxide colours prepared by burning ochre.

Lithopone.—This important pigment invented by John Orr in 1880, is called also "Charlton White," "Orr's White," "Beckton White," etc. It is a compound of zinc sulphide and artificial barium sulphate in the proportion approximately of one-third of the former and two-thirds of the latter. It is the base of most of the washable water distempers and flat wall paints, and is produced to the extent of hundreds of thousands of tons a year. Dr. Maxmillian Toch, in his admirable work, "Chemistry and Technology of Paints," says: "Lithopone has gone through many vicissitudes: no pigment has been blackguarded quite as much as this, and yet no pigment has survived its condemnation as well as this. Almost every paint manufacturer in the United States finds some excellent use for it. Within the last seven or eight years lithopone has come into its own, and to-day there is no paint manufacturer in the United States, to the best of the author's knowledge, who does not use this material. Ten years ago very few paint manufacturers used it at all." Lithopone has extraordinary body and covering capacity. It is used to some extent in the cheaper grades of enamel paints and, as already stated, is the best for flat oil paints when it is mixed with China wood oil. It has a peculiar property of changing colour when exposed to the sunlight, but some brands are now produced which are free from this defect. Experiments have proved that it does not make a durable paint on outside work.

Madder Lake.—Madder chromes and lakes of various beautiful bright colours are of organic origin, being made from the madder-root such as, rose

madder, pink madder, madder carmine, madder purple, madder brown, etc. They are often supplanted by the alizarine colours.

MAGENTA.—An aniline colour on a base of alumina. It is very fugitive and cannot, therefore, be recommended even for artists' use.

MALACHITE GREEN.—A dark rich green manufactured from malachite rock, which contains a considerable amount of copper oxide. It is also made artificially.

MANGANESE VIOLET.—An expensive permanent violet pigment, permanent to light, and useful for the artist's special effects, but cannot be used for fresco or similar work.

MARS COLOURS.—The series of colours named :— Mars Orange, Mars yellow, Mars red, Mars violet, and Mars brown are artificial ochres subject to different degrees of heat which yield the various colours named.

MAUVE.—One of the first coal tar colours, discovered by Sir William Perkins in 1856. Mauve is now made from coal tar colours, and is of a brilliant violet hue. This colour has a peculiar property of losing its characteristic beautiful tone when viewed under the artificial light, when it becomes quite grey in comparison.

MINERAL GREY.—This colour varies largely in its quality, being sometimes made from genuine ultramarine, but more frequently by a mixture of lamp black, ultramarine and zinc oxide.

MINERAL WHITE.—Another name for terra alba, *which see.*

MINIUM.—Another name for red lead.

NAPLES YELLOW.—Although formerly this colour was a compound of lead and antimony, the pigment sold under this name at the present time is usually a mixture of zinc oxide, yellow ochre and Venetian red, if in water, or French ochre and Venetian red and white lead, if in oil.

NEUTRAL TINT.—A mixture of indigo, black and alizarine crimson; a useful water and oil colour, now made in such a manner as to be quite permanent.

New Blue.—A pale variety of French ultramarine.

Nottingham White.—Another name for white lead reduced or adulterated with barytes.

Ochre.—Ochres vary very largely in composition and appearance, and may be grouped with the siennas. They are native earths containing a large proportion of silica, alumina and ferric oxide, the latter giving the characteristic colour. They are cheap and very permanent. The brightest varieties are called Oxford ochres. When calcined they become a rich red colour, useful for many purposes. They have been tried for use as priming paints in America, but without success. The physical condition, fineness, etc., is of much more importance than the analysis. The fineness and purity of colour determines their quality as far as the house painter is concerned.

Oxford Ochre.—One of the brightest varieties of native ochre, very rich in colour and esteemed on that account. The vein of the genuine Oxford ochre is said to be exhausted, but similar tinted ochres are found in various parts of the world. Not infrequently orange chrome is added to ordinary ochre to imitate the colour.

Oxide of Chromium.—A chromium sesquioxide, also called viridian. It is a valuable and durable pigment, similar in colour to terra verte, one variety being made which is rather transparent.

Purple Lake.—A crimson lake having a purple hue.

Para Red.—The word para is an abbreviation of paranitraniline. A series of aniline colours which are valuable because of their high degree of permanence when exposed to light and air. In admixture they produce fine scarlet colours.

Plumbago.—*See Graphite.*

Primrose Yellow.—Is a name sometimes applied to strontian yellow, and sometimes to a lighter shade of zinc chrome.

Prussian Blue.—A ferric-cyanide of iron; has very great staining power, and is nearly, but not quite,

permanent. The following remarks by Dr. Toch, in "Chemistry and Technology of Paint" (Crosby Lockwood and Co.), are worth recording:—"There is much discussion among paint manufacturers as to whether Prussian blue is a permanent pigment or not, and the author is frank to say that this matter can be decided as follows:—Prussian blue, or any of its varieties, may be considered permanent or fugitive according to the manner and according to the base with which it is mixed. If Prussian blue contains more than a trace of soluble salt (sodium sulphate), it has a decidedly yellow action on the oil, and a light blue or light green made of such Prussian blue is supposed to be fugitive. On the other hand, a number of experiments made with thoroughly washed Prussian blue have demonstrated that it is a perfectly stable colour, and does not change its shade. As a tinting colour for making pale blues in mixed paints, Prussian blue has caused an enormous amount of trouble. A pale blue mixed paint that contains white lead in any proportion changes colour in the package, a reduction process taking place which converts it from a ferric into a ferrous state, so that when a can of light blue mixed paint made with Prussian blue and white lead is opened, it is a sickly green instead of a blue. If such a paint be applied to an exterior surface it is completely converted into its original blue shade as soon as it is dry. The zinc oxide paints have the same action, but to a very small degree, and the paint manufacturer who desires to make a pale blue by the use of Prussian or Chinese blue must avoid the use of white lead in his paint. The artificial cobalt blue, mixed with zinc oxide is, however, most desirable."

Prussian Brown.—A Prussian blue which has been subjected to heat.

Raw Sienna.—A native sienna which has been levigated and ground for use.

Red Lead.—This valuable pigment is lead oxide (Pb_3O_4). The process of manufacture has been much

improved in recent years and the higher grades have a much lesser content of free litharge than formerly. Large quantities of genuine red lead are regularly sold in both paste and ready-mixed form, and that trade has increased enormously during the last few years.

Red Ochre.—A native ochre of rich red variety.

Roman Ochre.—A rich variety of ordinary ochre produced by heating.

Rose Doree.—A rose madder of scarlet hue.

Sap Green.—A water colour made from buckthorn berries.

Sepia.—A rich dark brown colour much used by artists, and prepared from cuttle fish. It can only be used in water and is fairly permanent. A colour in oil is sometimes sold under this name; it is a mixture of Cologne-earth and bone brown.

Smalt.—Powdered glass, coloured with cobalt. Sometimes used in sign painting.

Strontiam White.—White earth similar in properties to barytes.

Sublimed Blue Lead.—This is derived by smelting lead sulphide ore in special furnaces, the result being a pigment which, when mixed with a proper amount of pure linseed oil, makes a rust resisting paint of value. The raw material used in the manufacture is galena or lead sulphide ore. The burning yields a slate grey colour of almost impalpable fineness. In fact, it is claimed that, with the exception of lamp black, sublimed blue lead is the finest pigment in use to-day. If the colour is not that required, it may be mixed with chrome yellow to produce various shades, or equal quantities of chrome green which gives a nice olive green. When mixed with 50 per cent. red lead it gives a deep purplish colour. The manufacturers are The Eagle Picture Lead Company, of Chicago.

Terra Alba.—Sulphate of calcium or gymsum has little or no body in oil, but is very useful in water. It

is largely used in some brands of Venetian red and forms the base of a well-known water paint.

TERRA VERTE is a natural earth colour levigated and ground. It has a bluish grey tint, somewhat transparent, and is very permanent. Dr. Laurie, in investigating the permanence of the colours used by the old masters, found that all such colours were of native origin.

TUSCAN RED.—This name is applied to a colour made by precipitating alizarine on to a base of iron oxide.

ULTRAMARINE.—The genuine article, which is extremely expensive, is an extract of the mineral *lapiz lazuli*. The artificial ultramarine is called also new blue, French blue, permanent blue, etc. The latter is permanent to light; can be used with chalk in making distempers and is manufactured in a very large variety of qualities. The composition may be said to be compound of silica, alumina and soda with the addition of sulphur. It stands heat well, but is decomposed by acids. It should not be used with white lead. It has but little body, but is quite permanent. One variety is made from potash instead of soda, and this yields a colour somewhat similar to cobalt.

VANDYKE BROWN.—This is an earth colour valuable to painters in general and grainers in particular. It consists of organic matter to the extent of about 80 per cent. and mineral matter 20 per cent. It is a very slow dryer, has little covering power and is imitated by mixing together lamp or other black, red or oxide, yellow chrome.

VENETIAN RED.—An artificially prepared iron oxide of a light red colour, lighter than Indian red, and sometimes mixed in its preparation with large quantities of gypsum.

VERDIGRIS.—This is a basic acid of copper, which is very poisonous and is, therefore, but little used to-day by painters, various aniline greens having taken its place.

VERMILION.—This ancient pigment is a compound of mercury and sulphur, and was formerly manufactured

from the mineral cinnabar, but has for many years been made artificially. It is a bright scarlet colour and is one of the heaviest pigments available. It resists the action of alkalis and most acids, and is usually protected by a coat of varnish. It may be used with safety for most work, but has a peculiar property of turning black when exposed to the heat of the sun. It should not, therefore, be used for outside work exposed to a southern aspect. It is sometimes glazed with an alizarine colour which gives a very beautiful effect.

VERMILIONETTE.—This pigment is sometimes called "American Vermilion," "Derby Red," "Victoria Red" or "Vienna Red." It is made by striking an eocene colour on a good quality red lead, which gives it a considerable opacity. It will not resist heat and has been supplanted to a considerable extent by other and more permanent reds.

VERONA BROWN.—Terra verte, which has been subjected to heat or calcined.

VERONESE GREEN.—Another name for terra verte.

VIRIDIAN.—Hydrate oxide of chromium, sometimes called Guignet's green. It is also occasionally known as chrome green. It is a beautiful, bright colour with a slightly yellowish tone; of good body, and is much more permanent than chrome greens for artists' purposes. It was introduced by Messrs. Winsor and Newton, Ltd., who describe it as: "A hydrated and very transparent variety of chromium sesquioxide." It was originally introduced by their house.

WHITING.—Carbonate of calcium made from chalk by process of levigation. It is also known as gilders' whiting and Paris white, the latter being of very fine variety. It is the basis of old-fashioned distempers, which are still used to a considerable extent where a cheap finish is required. A disadvantage is that such distemper becomes much darker in the presence of damp. Whiting destroys certain colours when mixed with it, and those which are safe will be found in a table at the end of this book.

A Selection from the

B.E.S.A. Proposed Standard Shades for Prepared Paints.

PLATE XV.

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BRITISH ENGINEERING STANDARDS ASSOCIATION

(Plates Prepared by The Mitchell Colourcard Company).

WHITING.—This pigment is sold as "Paris white," "Gilders' white," "Spanish white," and "English white." It is calcium carbonate or chalk. It is largely used as a base for distempers, and is sometimes employed as a base for the lakes. When mixed with water it has extraordinary good body, but when ground in oil the body disappears. It is occasionally used as an adulterant in oil paints, but is objectionable owing to the fact that it causes such paint to lose its opacity. When ground with about 20 per cent. of raw linseed oil it forms the ordinary putty of commerce, and when to this has been added 25 per cent. of dry white lead, forms a special putty used by painters for filling up nail holes, etc. Whiting has the property of quickly absorbing moisture and, therefore, in the manufacture of the best grades of putty a stove is used close by the pug mill in which the putty is to be ground. The stove heats the whiting and dries off the moisture, and the whiting itself, in the form of powder, is then taken by a worm conveyer to the mill, and during that time has an opportunity of cooling. Being immediately mixed with oil, under the heavy edge runners, all moisture is eliminated. Whiting is found naturally in the form of chalk on the south coast of England and many other places. The process of manufacture is levigation and grinding to a very fine powder, and afterwards, in some cases, passing the material through a silk sieve which gives the fine gilders' whiting, which is so much esteemed.

WHITE LEAD.—This is probably the best known and most largely used pigment in existence. It has a basic carbonate of lead, and is made by several different processes, the latest, and in many respects the best, being the old Dutch or Stack process in which the metal lead in the form of "wickets" of thin plates perforated with holes at frequent intervals, are exposed in a stack sealed up to the action of weak acetic acid. This acid is contained in earthen pots placed close together on a layer of tan, and is left for a period of about 90 days, during which

the tan ferments and gives a mixture of carbon dioxide and vapour from the acetic acid. This converts the metal lead into white lead. The buckles are afterwards passed through the mills to free the white lead from the uncorroded metal, and afterwards reduced to powder, washed or otherwise dealt with. White lead is sold either dry in the form of powder or as a paste mixed with linseed oil, or in ready-mixed form. White lead is described elsewhere in this book. Its popularity is due to the fact that it has excellent body, and is easily applied. Its objections are: that it is poisonous, and that it is easily affected by sulphuretted hydrogen and impure gases.

YELLOW OCHRE. *See Ochre.*

ZINC GREEN.—Another name for cobalt green, *which see.*

ZINC OXIDE.—This pigment has grown rapidly in favour in recent years owing to the fact that it is non-poisonous, beautifully white and can be mixed with any other pigment without being affected. It was originally called in the trade "zinc white," and previous to that Chinese white. The last name is still used in connection with that quality which is prepared for artists' use. It is unaffected by most gases, and while it is superior to white lead, in some respects, it has not such good body owing to the large amount of oil which is necessary in grinding it. This fact, however, gives it a greater spreading power, but it has a tendency to crack. The greater part of the zinc oxide used in England comes from France, Belgium and America. There are two principal methods of manufacture: first, the French system, being to burn metal zinc, called spelter, in an open oven, whence it absorbs oxygen from the air and passes the smoke through a long series of bags, and when cooling is converted into a fine white powder, the finest being that portion which is found in the more remote parts of the bags. In the American system the zinc oxide is made

direct from the zinc ore. In making comparative tests of colour mixture on a white base it is always advisable to use zinc oxide in preference to any other pigments. In ordering care should be taken not to use the term, zinc white, *which see.*

Zinc White.—Until 30 years ago the term zinc white was applied to zinc oxide. Since the invention of lithopone (*q.v.*) the term is frequently applied also to that material, which is of an entirely different character. The only safeguard is to order zinc oxide as such by that name only when it is required.

Zinc Yellow.—A zinc chrome which is free from lead and is not, therefore, affected by sulphurous gases. It is fairly permanent and in oil produces tints sometimes preferred to the lead chromes.

PIGMENTS AND THEIR PROPERTIES.

Pigments Liable to Change under the Influence of Sulphuretted Hydrogen, Air, and Moisture:

Yellow.—Chrome yellow, mineral yellow, Naples yellow.
White.—Chremnitz white, flake white, pearl white.
Red.—Red lead, purple red, iodine scarlet.
Green.—Verdigris, Scheele's green, emerald green mountain green.
Blue.—Prussian blue, Antwerp blue.
Orange.—Orange chrome.

Pigments Little Liable to Change under the Influence of Sulphuretted Hydrogen, Air and Moisture:

White.—Zinc white, constant white, tin white.
Red.—Vermilion, red ochre, Indian red, madder lakes.
Yellow.—Yellow ochre, barium chromate, zinc chromate, aureolin, raw sienna.
Green.—Chrome green, cobalt green.
Blue.—Ultramarine, smalt, Thenard's blue.
Brown.—Vandyke brown, raw umber, burnt umber, manganese brown, sepia.
Black.—Ivory black, lamp black, Indian ink, graphite.
Orange.—Orange vermilion, burnt sienna.

PIGMENTS LIABLE TO DETERIORATION WHEN IN CONTACT WITH WHITE LEAD, CHROME OR OTHER LEAD PIGMENT:

Yellow.—Yellow orpiment, king's yellow, Indian yellow, gamboge.
Red.—Iodine scarlet, cochineal, carmine.
Orange.—Golden antimony sulphide, orange orpiment.
Green.—Sap green.
Blue.—Ultramarine.

PIGMENTS WHICH ARE LITTLE AFFECTED BY HEAT, AND WHICH MAY BE EMPLOYED WHEN THE MATERIAL HAS TO STAND FIRE:

White.—Tin white, barium white, zinc white.
Red.—Red ochre, Venetian red, Indian red.
Yellow.—Naples yellow, antimony yellow.
Blue.—Smalt and royal blue, ultramarine.
Green.—Chrome green, cobalt green.
Orange.—Burnt sienna, burnt ochre.
Brown.—Burnt umber, manganese brown.
Black.—Graphite, mineral black.

COLOURS THAT MAY BE USED WITH LIME:

White.—Permanent white, *i.e.*, baryta white, gypsum, zinc white.
Red.—The vermilions, light red, Venetian red, Indian red, madder lakes.
Orange.—Cadmium, orange chrome, Mars orange, burnt sienna, burnt Roman ochre, light red.
Yellow.—Aureolin, cadmium yellow, lemon yellow, Naples yellow, Mars' yellow, raw sienna, yellow ochre, Roman ochre, transparent gold ochre, brown ochre, Indian yellow, Oxford ochre.
Green.—Oxide of chromium, transparent oxide of chromium, viridian, emerald green, malachite green, verdigris, terra verte, cobalt green, chrome green.

Blue.—Genuine ultramarine, artificial ultramarine, new blue, permanent blue, cobalt blue, cerulean blue, smalt.

Purple.—Purple madder, Mars' violet.

Brown.—Bone brown, bistre, Prussian brown, burnt umber, Vienna brown, Vandyke brown, Cologne earth, asphaltum, Cassel earth, manganese brown.

Citrine.—Raw umber, Mars' brown.

Blacks.—Ivory black, lamp black, blue black, charcoal black, cork black, Indian ink, black lead, drop black, plumbago.

Permanent Pigments.

All pigments in list hereunder are absolutely permanent, and can be mixed with each other, or used separately, without interacting upon each other. They are unaffected by light, and in other words they are true, permanent pigments. (Max Toch.)

Alizarin Crimson.
Aureolin.
Baryta White.
Barytes.
Blanc Fixe.
Blue Black.
Burnt Sienna.
Burnt Umber.
Cadmium Yellow.
Cadmium Orange.
Cadmium Yellow Pale.
Carmine in oil.
China Clay.
Chinese White.
Cobalt Yellow.
Constant White.
Cremnitz White.
Graphite.
Gypsum.
Mars Violet.
Mars Yellow.
Mineral White.
Naples Yellow (French).
Neutral Tint (oil).
Oxide of Chromium.
Oxide of Chromium, transparent.
Permanent White.
Plumbago.
Raw Sienna.
Raw Umber.
Red Ochre.
Roman Ochre.
Satin White.
Silver White.
Strontiam White.
Terra Alba.
Terre Verte.

Indian Red.
Ivory Black.
Lamp Black.
Light Red.
Mars Orange.
Mars Red.
Venetian Red.
Whiting.
Yellow Ochre.
Zinc Oxide.
Zinc White.

ALL THE FOLLOWING ARE ABSOLUTELY PERMANENT WHEN USED ALONE, BUT ARE NOT PERMANENT WHEN MIXED WITH SOME OTHER COLOURS.

Antwerp Blue.
Cobalt Blue.
Emerald Green.
Flake White.
Hooker's Green, 1 & 2.
Madder Lake.
Ochre.
Para Red.
Paris Blue.
Prussian Blue.
Ultramarine (artificial).
Vermilion.

ALL THE FOLLOWING PIGMENTS DRY SLOWLY AND IRREGULARLY.

Alizarin Yellow.
Alizarin Green.
Alumina White or Lake White.
Bone Brown.
Brown Madder.
Brown Pink.
Carbon Black.
Carmine Lake.
Crimson Lake.
Crimson Madder.
Gamboge.
Indian Yellow.
Indigo.
Italian Pink.
Lamp Black.
Magenta.
Mauve.
Orange Cadmium.
Payne's Gray (oil).
Rose Doree.
Sap Green (oil).
Scarlet Lake.
Sepia (oil).
Vandyke Brown.
Violet Carmine.
Yellow Lake.

PIGMENTS WHICH ARE AFFECTED BY SULPHUR GASES AND IMPURE AIR.

Chrome Green.
Chrome Orange.
Cremitz White.
Emerald Green.
Flake White.
Lemon Yellow.
Naples Yellow (oil).
Naples Yellow (light).
Naples Yellow (medium).
Naples Yellow (deep).
Naples Yellow (reddish.)
Silver White.
Verdigris.
White Lead.

PIGMENTS WHICH ARE AFFECTED BY LIGHT.

Brunswick Green.
Gamboge.
Lithopone.
Orris White.
Pink Madder.
Rose Doree.
Rose Madder.
Sepia (oil).

FUGITIVE COLOURS.

Bistre (water).
Brown Pink.
Burnt Carmine.
Carmine in water.
Chrome Green.
Citron Yellow.
Crimson Lake.
Dutch Pink.
Indigo.
Magenta.
Olive Green (oil).
Prussian Green (oil).
Verdigris.
Violet Carmine.
Yellow Carmine.
Yellow Lake.

DESCRIPTION OF COLOURED PLATES.

PLATE I.

The twelve beautiful examples of colours shown on this plate will all be found very acceptable to decorators, particularly those who are called upon to do high-class work by up-to-date methods and materials. Both the "Combinol" flat oil paint and the Combinol hard drying gloss paint shown on the plate may be said to belong to the modern and greatly improved system of manufacture which has put in the hands of decorators during recent years properties which a few years back were not available. "Combinol" flat oil paint possesses the advantage of not only giving a dead, flat finish, quite uniform and easy to apply, but one which, when occasion requires, may be washed or even scrubbed down as needed. From a purely descriptive point of view, the use of "Combinol" will save a great deal of time in mixing as well as in application. Many more colours than those shown on the paper are made, and a colour book will be sent to any reader who writes to the manufacturers, Messrs. Goodlass, Wall & Co., Ltd., Seel Street, Liverpool. Very artistic effects can be produced by a judicious use of these colours. For example, a very beautiful blue room can be done with the neutral blue and deep art blue used together, the former on panels and the latter on surrounds in a modern room.

"Combinol" hard drying gloss paint is also made on the up-to-date principle, which is this: Although linseed oil is recognised as the proper medium for use in connection with all ordinary house painters' oil paints, careful investigation and experiment have proved that the paint is greatly improved both in appearance and durability by the addition of specially selected varnishes

made from hard gum resins used in the course of its manufacture. This varnish strengthens the linseed oil in the same way as steel reinforces or strengthens concrete in the modern construction of buildings. It makes it last longer because, being so hard, it is able to resist the action of the weather upon it. It looks better because of the increased gloss and when it is applied over a proper ground there is no fear of deadening, but the gloss will remain permanent for a very long time, which means practically as long as the paint itself will last.

PLATE II.

In this plate are shewn a number of the standard colours in which the "Minerva" Red Label Paint is made. Elsewhere in this book it has been explained that the firm of Messrs. Pinchin, Johnson and Co., Ltd., of General Buildings, Aldwych, London, W.C. 2, held a competition some years ago, which had for its object the standardization of the best known colours. Some of these standard colours are given in plate II and it will be interesting to compare them with those selected by the Committee of the British Engineering Standards Association and also with the other plates in this book.

At the bottom of the plate is given an example of the tints obtained by adding certain proportions of gloss white to emerald green. It will be seen that the effect produced by adding three parts, seven parts, fifteen parts and thirty-one parts of white is given. Messrs. Pinchin, Johnson and Co., issue a card in which is given the reductions on this basis of all their colours and a copy of this very useful card can be obtained by writing to them at General Buildings, Aldwych, London, W.C. It may be added that "Minerva" was one of the first of the high-grade ready mixed paints to be placed on the market and that it is sold in enormous quantities in all parts of the world.

PLATE III.

Sixteen selected colours of "Hygeia," the well-known flat wall paint, are shewn on this plate. This material is made in thirty-two colours. It has the advantage of producing a soft and very pleasing finish, and it sets so hard that it may be washed or even scrubbed if necessary. The material is particularly well fitted for high-class and domestic decoration, public halls and buildings, hotel rooms and corridors, cinemas, hospitals, schools, etc. It is supplied ready for use and the colours may be intermixed or white added. Stippling is not necessary, although it may be carried out where required. It works about as easily as a fairly thin paint and flows akin to a good enamel or varnish. It dries fairly rapidly, but stays open long enough for edges to be picked up when sensibly worked, and therefore, large flanks can be treated with confidence. New plaster patches should be allowed to dry out as hard as possible and then be given three coats of "Hygeia" Preparatory Coat.

PLATE IV.

This plate gives a selection of the colours of Naylors' Super Elastic Gloss Paint, manufactured by Messrs. Naylor Brothers (London), Ltd., Slough, Bucks. The colours are very clear and the paint is well calculated to give satisfaction both on account of its admirable appearance and its durability. It is recommended that a special undercoat be used with this paint, as it enables the work to be finished with less coats, but it is not essential that such undercoat be used. This gloss paint is made in many more colours than those shown and readers of this book desiring to receive a complete colour card, should write to the firm at the address above given.

PLATE V.

The 20 different colours of "Muralbo" flat finish and undercoatings shewn on this plate cover a wide

ground and will be found useful for ordering and for general reference. This speciality is made by the Yorkshire Varnish Co., Ltd., of Ripon, Yorkshire. It is ground in a straight flat enamel medium, which gives it perfect flow, absolute ease of application and that luminous silky finish so much desired by the professional decorator. The following are instructions for application:—After having seen that the surface to which the paint is applied is quite clean and smooth, holes or cracks may be stopped with a putty made from whiting mixed with "Muralbo," taking care to get the colour of the putty as near as possible to that of the finishing coat. Now thin 7 lbs. of body colour with one quart of boiled oil, one quart of varnish and one quart of turpentine or white spirit. The first coat will then be ready for application. For the second coat, thin 14 lbs. of body colour with turps or white spirit to make one gallon.

For a varnish finish, "Muralbo" may be used as an undercoat, with advantage, as it has excellent body and spreading power.

PLATE VI.

During the last few years a new class of paint has been placed on the market, of which this plate gives some examples. The paint in question is intended to imitate stone, which it does most successfully, especially when it is lined with white to represent the joints.

The samples shown on the card are those of "Petrumite," manufactured by Messrs. Naylor Brothers (London), Ltd., Slough, Bucks., and it is particularly well fitted for the decoration of churches, halls, cinemas, porches, staircases, etc., and is also used with success in sitting rooms, especially those somewhat elaborately furnished, the plain background serving to throw up the details of the furniture with good effect. It can be used either inside or outside, and is particularly recommended for use on walls, which are exposed to an unusual amount of rain or damp. It dries hard in six to eight hours with a rough weather resisting surface. It

does not require a key on bare wood or stone and on such surfaces two coats are sufficient. It is made in grey, buff, terra-cotta and to imitate various stones, as shown in the plate. The following is the method of application :—Apply with a flat brush and when tacky, stipple lightly. When hard, apply a full flowing setting coat and stipple lightly with a soft brush, slightly moistened with turpentine. If a smooth finish is required, knife off the second coat when it is tacky and then stipple with a soft brush moistened with turpentine. When this last coat is nearly hard, cut out joints and, if desired, line with zinc white paint and give the effect of pointings. If necessary, the paint can be thinned with turpentine. This paint does not clog the brushes, which after use can be easily cleaned with white spirit, or other first-class turpentine substitute. The success of this work will depend, as far as appearance is concerned, to some extent upon the skill which is exercised in setting out the joints. They must be distributed exactly in the same way as though the work were real dressed stone. Therefore, of course, no vertical joints must come over window or door opening.

It may be of interest to note that "Petrumite" imitation stone paint was used at the Carlton Hotel, London; the Midland Adelphi Hotel, Liverpool; King Edward VII. Hotel, Toronto, and many other important buildings.

PLATE VII.

Twenty-seven examples of the most important artists' water colours, manufactured by the well-known firm of Winsor and Newton, Ltd., 38, Rathbone Place, London, W., are shown on this plate. The specimens are washed by hand on Whatman paper, and are graduated in order to show the difference between thick and thin washes.

All of these colours belong to Class 1, Division 1, of Messrs. Winsor and Newton's lists, and are classified as being absolutely permanent colours. Of course,

they are only a selection of the colours made by Messrs. Winsor and Newton, and a full list may be obtained by those interested who write to the firm at the address above given.

PLATE VIII.

On this plate are shown 27 examples of Winsor and Newton's artists' oil colours. The same names are in several instances used for water-colours shown on Plate VII., and the reader will find it useful to compare the two in order to obtain an accurate idea of the difference in appearance between a pigment ground in water and one ground in oil.

These oil colours are also classified as being absolutely permanent. They are, it need hardly be said, of much higher grade than ordinary house painters' oil colours and are correspondingly more expensive, but in high class decorative work, they will be found very valuable for obtaining effects which are practically impossible when the ordinary type of colours are used.

PLATE IX.

This plate shows in a striking manner the novel and very pleasing effects which may be produced by means of the speciality called "Parso-Glaze," manufactured by Messrs. Thomas Parsons & Sons, of 315-317, Oxford Street, London, W. The effects are produced in a very simple manner by means of the Parso-Glaze scumbling and rubber stipplers. The ground is prepared according to the colour it is desired to have for the finishing coat, and a day should be allowed before the coat of Parso-Glaze is applied. This is put on freely all over the work and then the rubber stippler is used to produce the effect shown in the plate, and the paint is so made that it will not flow together after stippling or graining for which purpose a colour may be used with great advantage.

There are four grades in the stipplers, ex-coarse, coarse, medium and fine, and they may be used according

to taste on different parts of the work. For example, supposing the wall of a room is divided up into panels according to the modern custom, the panels can be stippled with a fine stippler, and the stiles or surrounds with the medium or coarse stippler, and similarly in a door or on wainscotting the variation can be made without difficulty.

Messrs. Parsons & Sons make altogether twenty-five standard shades of Parso-Glaze, and these may be varied in use according to the judgment of the decorator. The range of colours and full particulars of Parso-Glaze may be obtained from the firm.

PLATE X.

The waterpaint known as "Nayrodec" is shown on Plate X. in various typical colours. The material is manufactured by Messrs. Naylor Brothers (London), Ltd., Slough, Bucks. A point of special interest concerning this waterpaint is that on new plaster and brick work, the colour is lime resisting. Also, that the colour resists on acids, as well as carbonic acid in the air, and for that reason is much more durable than any similar materials. It can be varnished over if desired.

PLATE XI.

This plate gives twenty-seven different colours of Church's "Alabastine," including the three (A, B, and 31)primary tints shown on Plate XII. The manufacturers, Alabastine Co. (British), Ltd., 16, Church Street, London, S.W.8, recommend that shades 6, 7 and 34 are best in one-coat work on prepared walls, and that two-thirds white Alabastine should be added for the first heavy coat. A careful study of this plate is also recommended.

It may be added that "Alabastine" has many uses in addition to that of distemper. It may be used most successfully as a hard filler for bringing work to a level surface; as, for example, under white enamel work. It is also employed in the following manner to produce

varied novel effects, but the ground is prepared with "Alabastine" of, say, for example. a deep red colour similar to 31. Upon this is given a thick coat of white or lighter colour, and while the last coat is still wet, it is combed with a coarse grainer's comb with a wavy motion. This removes some of the white and shows the red beneath, giving a very pretty effect. The comb may be moved, of course, in any direction, the example may be employed so as to produce scollops or in a hundred-and-one different ways which would occur to the ingenious reader. Further variety may be given by placing the end of a fairly large brush against the wet top coat and giving it a twisting motion which will form something of the nature of a rosette. A thicker variety of the same material suitable for modelling and high reliefs is manufactured by the same firm and is called "Alabastine-Opalia."

PROPORTIONS OF MATERIALS FOR PRODUCING COLOURS SHOWN ON PLATE XII.

No. of Colour.	White.	31	B.	A.	No. of Colour.	White.	31	B.	A.	No. of Colour.	White.	31	B.	A.
62	6	1	1	1	74	—	1	4	$\frac{1}{4}$	86	8	$\frac{1}{2}$	1	$\frac{1}{2}$
63	5	4	2	3	75	6	—	1	—	87	6	$\frac{1}{2}$	$1\frac{1}{2}$	3
64	—	5	3	4	76	5	$\frac{1}{4}$	3	1	88	—	1	1	4
65	8	1	—	—	77	2	—	4	$\frac{1}{2}$	89	10	$\frac{1}{2}$	1	—
66	4	2	—	1	78	10	2	3	4	90	10	2	4	—
67	4	6	—	3	79	—	3	4	5	91	—	$2\frac{1}{2}$	4	—
68	—	1	—	1	80	—	$2\frac{1}{2}$	4	1	92	—	1	1	—
69	8	—	—	1	81	10	$\frac{1}{4}$	$\frac{1}{4}$	—	93	—	5	3	2
70	4	—	—	1	82	8	1	$\frac{1}{8}$	—	94	—	4	2	1
71	6	—	$\frac{1}{4}$	$10\frac{1}{4}$	83	4	1	$\frac{1}{8}$	—	95	8	—	2	1
72	10	—	1	—	84	8	3	$1\frac{1}{2}$	—	96	8	—	3	2
73	4	$\frac{1}{2}$	2	—	85	2	2	$\frac{1}{2}$	—	97	—	1	4	5
										98	—	—	1	1

PLATE XII.

This plate is worthy of very careful study because it shows in a very practical manner how forty different colours, shades or tints may be obtained by mixing together various proportions of red, blue, yellow and white. These primary colours are marked on the plate "31," "A," and "B" respectively. All the colours are made from the well-known water paint "Alabastine," which possesses great merit and has a very large sale among decorators. The proportions for producing all the colours shown on Plate XII. are given below, and it is suggested elsewhere that anyone desirous of learning colour mixing would spend his time very profitably by mixing up these colours, as the results obtained would lay a foundation for a good practical knowledge on the subject. A practical house painter will readily see another advantage, which is that instead of stocking forty different colours he has only to stock four, including the white, as from these he can so readily obtain all the others.

Before giving the proportions that should be used to produce each tint, it may be well to remark that when "Alabastine" is floated freely, one coat is sufficient on most walls, but where there is much suction, preparation of the surface, as per instructions given, is necessary. The "Alabastine" is supplied in dry powder, the proportions are mixed according to rule, and as shown in the list which follows. The actual mixing is effected with the dry colours, cold water is then added, and after stirring, the material is ready for use. A beautiful surface is thus readily produced.

Referring to the numbers marked against each tint on Plate XII., the following are the proportions that are to be used. A convenient way of measuring the material is to use an ordinary tea-cup, but care must be taken to pour in the "Alabastine" lightly in each case. If the cup or measure is knocked on the bench so as to cause the material to pack, it will, of course,

hold more than it would do otherwise, and if it is packed in one case and not in another, the colour will not come out as intended. The reader is recommended to use a tea-cup or similar measure, and to put the material in, as far as possible, in each case in the same way. All the colours shown on this sheet are stippled, this giving a more artistic result than can be obtained by brushing out.

PLATES XIV AND XV.

It is generally known that a series of Standard Specifications for paint ingredients is in course of preparation by the British Engineering Standards Association, 28, Victoria Street, London, S.W.1, through various Committees or Panels. These represent all the principal interests involved such as the various Government Departments, the Incorporated Institute of British Decorators, the National Federation of Associated Paint, Colour and Varnish Manufacturers, the Royal Institute of British Architects, the Oil and Colour Chemists' Association, the National Federation of Master Painters and Decorators of England and Wales, and other important bodies. Several of these specifications have already been issued, and they are published at 1s. each and post free 1/2, and can be had from the Association at the address given.

One of the Panels, namely, that dealing with Ready Mixed Paints, realizing the desirability of standardizing the names of colours of such paints, with that object appointed a Sub-panel, of which the author of this book was a member.

The first step taken was to obtain colour cards of all the principal manufacturers of ready mixed paints in this country, and to mount them on different cards, all colours sold under the same name being mounted on the same card. In some cases, as many as 200 samples of the same colour name appeared on the same card, but the actual colours varied very greatly.

The compilation of these cards was most instructive in showing the wide divergence of colours sold under the same name and it fully justified the appointment of the Sub-panel.

The Sub-panel realized that it would be impossible to name every colour and therefore, they took about 100 of those colours which occurred most frequently in the colour cards. They first made a selection from the small tabs and afterwards through the courtesy of Mr. Frederick Scott Mitchell, were enabled to examine large sheets painted out with the various colours, tints, or shades and to accept or reject them according to whether they did or did not come up to their idea of what the particular named colour should be.

All the samples were ultimately placed before a Committee of selection, including several colour experts, decorators, architects and others, so that about 100 colours have now practically been standardized, to the great benefit, it is hoped, of the trade.

By the kind permission of the British Engineering Standards Association, a selection of 40 of the 100 colours are included in plates XIV and XV. The whole of the 100 will probably be issued in the form of a book by the Association later on. It will be published at a moderate price, and will be a great convenience to colour users. In ordering a colour or a particular hue it will only be necessary to name the B.E.S.A. Standard Card and know precisely what is wanted.

It is probable that the Sub-panel may ultimately name flat colours, such as washable distempers, and possibly also coach and motor colours.

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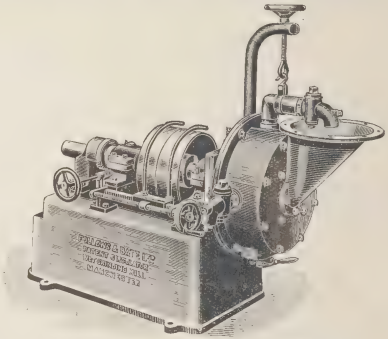

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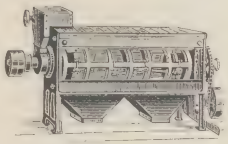

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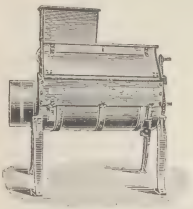

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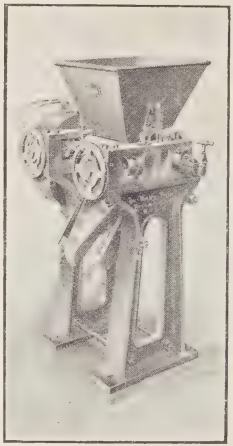

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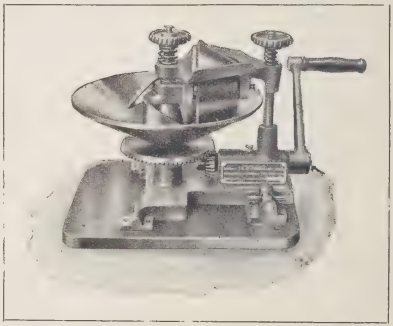

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